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THE SUMMER LOAD.

Generally speaking, the central-station business is a seasonal one. It is not in such bad case as the professional snow shoveler or the vender of palm-leaf fans, but it is an unhappy fact that the ordinary central station sees its loads and its receipts begin to dwindle as the long days of summer come on. By reason of this the fixed charges, which are always with us, run high per unit of output and the situation becomes generally somewhat unsatisfactory. The great problem before the central-station manager, particularly in relatively small places, is what to do in order to build up this discouraging period of low load. In rare instances the summer load is high, as in the case of occasional summer resorts, or it may even happen that the occupation of summer residences so builds up the load that in spite of the shorter hours the load all the year round is practically the same. This has been known to happen in some suburban places where the coming of the first of May brings a sudden influx of residents. However, these instances are altogether too few to be of much importance in the problem which confronts us. What, then, are the feasible outlets for summer load? Of course, the fan motor is always available, and vigorous soliciting will produce results not to be ignored. Motor service other than for fan motors is not a seasonal business to any considerable extent, but the close of the heavy lighting season releases energies that should at once be concentrated on extending motor service.

One of the few exceptions, however, is in favor of artificial ice making, which, as a side line for central stations, has been carried out successfully in a number of Western and Southern plants. Reports upon it of a very encouraging character have been printed in these columns and may be found in the records of the N. E. L. A. A few small refrigerating plants for marketmen's ice chests and the like may be picked up in the regular course of motor service, and these are more actively employed in summer than in winter. But with all these possible special outlets it still appears that the greatest chance for a profitable summer load is to be found in the use of minor electrical appliances for cooking and household conveniences generally. The electric flatiron and the electric stove, coffee urn and chafing dish ought to build up in many places a very substantial addition to the output of the summer months. All such appliances are strictly off the peak as regards summer business and, indeed, for the most part all the year round. They do not increase the investment or the fixed charges while they are running up the sales. The main difficulty in getting such load in most places has been that it has generally been charged for at the lighting rate.

Now, electrical appliances of the kind mentioned at lighting prices are distinctly luxuries, and rather expensive ones,

while at motor rates they may almost take their place as necessities. Electrical heating and cooking devices can never yield a substantial steady load and profit to central stations on ordinary lighting rates, and the sooner the central stations learn this lesson the better off they will be. It has been the custom for central stations, under whatever form of schedule operated, to make one price for lighting service and another price, generally a third or a half of the lighting rate, as the price of energy for motor service. The only legitimate reason for this distinction between the use of a kilowatt-hour for one purpose and the other has been based on the undoubted fact that the lighting service requires a good deal more care and expenditure to secure the regulation that is necessary for that particular kind of work. This is the basis of a genuine distinction; yet when this very distinction is made it is entirely obvious that the electric range and flatiron belong with motor rather than with lighting service. The maintenance of lighting prices for such appliances is merely, therefore, a measure of the indifference of the central station toward acquiring added load of this character. If the station manager can deliberately afford to neglect such output, as he frequently neglects the domestic lighting load, the situation is understandable. If, however, he really desires to build up his station load instead of satisfying himself with the profits which can be obtained from a comparatively small number of large consumers, he will put these incidental appliances in the class to which they legitimately belong and make some effort to obtain the kind of load that will be increased during the light months of summer business.

The objection generally raised to so doing is that the business does not warrant the installation of a separate meter, to which the answer is that until a separate meter or other separate device for charging is introduced there never will be any business of this character worth mentioning. If one cannot afford investment in meters to secure a substantial addition to his summer load, then he had better either put electrical appliances or lights, or both, on a flat rate, as has been done in a good many places already. Besides the actual profit which may be obtained from the smaller electrical appliances, there is also another phase of the matter which is fairly deserving of consideration, and that is the tendency which efficient service of this kind has toward making the use of electricity a necessity rather than a luxury. Central-station managers may well take a lesson from the success of telephone companies in making telephones a necessity. If each and every telephone installed were rigorously put upon the same schedule at a rate sufficiently high to insure a profit on every call, the telephone would to-day be where it was years ago. But the telephone companies have been willing to take chances, to arrange a set of schedules on the whole highly profitable to the company and yet suited to the needs and pockets of almost every customer. As a result they have pushed the telephone into use to an extent unknown in any other country in the world, and have made it a necessity of daily life, to the great profit of their stockholders. It is this kind of treatment which the domestic applications of electricity need in order to build up the summer profits of central stations to the point which they ought to reach.

THE MOTOR LOAD.

One of the most characteristic features of modern electric power development is its tendency to spread into every branch of industrial activity. Motor applications are finding a permanent place in all spheres of the manufacturing art, and many lines of business are responding to the economic stimulus of electrification. Despite the large growth of power sales which has been such a notable factor in the success of the central-station industry during the past decade, many opportunities remain for the exploitation of motor service in fields which are far from electrically saturated—fields offering a liberal return when occupied at the usual rates, and which in many instances remain remunerative when maintained by concessions standardized on the basis of off-peak or long-hour consumption. Typical opportunities for power development are offered by the restaurant, the storage warehouse, the brickmaking and stonecutting industries, to emphasize a few lines of service highly desirable from the standpoint of off-peak supply. Summer amusement park power and lighting also fall within the category of attractive loads, with the proviso, however, that the investment required to deliver energy at the distribution center shall be exceedingly small, for the period of use ordinarily is limited to the summer months.

The modern restaurant, and particularly the type of establishment which caters mainly to the noon trade in the heart of urban business districts, is well worth consideration from the power sales viewpoint. The advantages of electrical service are intensified in such places by the extraordinary value of real estate and resulting high rentals and taxes, the necessity of making every square foot of space tell, importance of cleanliness as a feature attracting patronage, and the enormous influence of convenience in handling the great volume of business compressed into a period of about two hours per day. The "peak load" of a popular café between noon and 2 p. m. overtops anything the average central-station load curve can show as the heights of Aconcagua dwarf the summit of Mount Washington; but, as the peaks are non-coincident in time, the business is worth putting forth unusual efforts to obtain. It includes refrigeration, the operation of large ventilating fans, running of air-compressor, pumping and dumb-waiter equipment, grinding, polishing, chopping and other machinery long since standardized in high-efficiency hotel service. All along the line down to the small establishments seating a score or two of patrons there are opportunities to supply both long-hour and off-peak business, the aggregate of even a handful of modest little establishments amounting to an attractive total.

Comparatively few storage warehouses handling produce and highly perishable goods are as yet consumers of central-station electricity, but the business is of sufficient importance in growing centers of population to justify a systematic attack upon its difficulties. Refrigeration lies at the foundation of this branch of industry, and the scale of operations is large enough to justify a very low motor-service rate. Even if experience shows that the cost of operating steam-driven apparatus is moderate in plants of this kind, it may be possible to introduce electricity on the basis of its economy in space, flexibility of motor-speed control and

simplification of equipment. In the brickmaking and stonecutting fields electricity has already made great inroads upon older and less efficient motive powers. Here the open weather seasons contribute to maximum production; the amount of power required even in small plants is large enough and in sufficiently protracted demand to justify a liberal investment in reaching the works. Low cost of operation is a prime factor, and electricity almost always guarantees this without anything like the amount of depreciation in machinery consequent upon the use of steam. In brick plants, especially, the motor drive has cut down the lengths of shafting to nearly negligible quantities.

PRELIMINARY WORK OF THE RESUSCITATION COMMISSION.

Whether electric injuries are incurred by negligence or by mere mischance, the fact remains that a certain risk exists when electrical energy is carried, on a large scale and at a high tension, for use in a community. In most cases an electric shock is not to be regarded as dangerous in itself, if the person receiving it is not rendered unconscious. Of course, a relatively slight shock received by a man when balanced on a high ladder may cause him to fall off and receive fatal injuries in his fall. But any electric shock which in itself produces unconsciousness in the subject should be regarded as dangerous. It is accepted from physiologists that the principal danger of an accidental electric shock lies in its possible effect on the heart. An effect of an electric discharge through the heart muscle is a dis-coördination of its functions in such a manner that its normal pumping or circulating action is interfered with, and it remains quivering, or fibrillating, to no purpose. Once the heart is set into fibrillation, so as to arrest the circulation completely, the chance for automatic recovery becomes greatly reduced. Nevertheless, the loss of consciousness of the individual does not necessarily mean that the heart has been set into fibrillation. In any event, the proper procedure on the part of bystanders, after freeing an unconscious injured person from contact with the source of current, and after sending for medical assistance, is to apply restoratives, and in particular to practise artificial respiration. The procedure indicated is the same as for the restoration of the apparently drowned, except that the latter are presumably unconscious from the effects of forcibly arrested respiration, whereas the unconscious shocked, like those who have fainted, are presumably suffering from an arrest of circulation. Consequently, the directions given medically for the use of laymen, in cases of accidental electric shock, detail some method for practising artificial respiration.

During the past fifteen years the regular method advocated for artificial respiration has been the Sylvester method, in which the subject is placed on his back and his arms are waved rhythmically up and down. More recently a rival method has made its appearance, known as the Schaefer method, in which the subject is placed prone on his chest. The operator then sits or kneels beside the subject, and, placing the palms of his hands on the back and lower ribs, gently throws his weight on and off about twelve times a minute, thereby alternately compressing the lungs and allowing them to expand elastically. So much discussion and dissension has appeared on the relative merits of the above two methods of practising artificial respiration that the matter was brought formally to the attention of the National Electric Light Association, which then appealed to the American Medical Association for assistance in investigating, not only artificial respiration, but the entire subject of resuscitation from electric shock. As was brought to the notice of our readers, the American Medical Association appointed a Resuscitation Commission, including five medical men and representatives from the American Institute of Electrical Engineers and the National Electric Light Association, the work of the commission to be carried on under the auspices of the last-mentioned body.

As is set forth in another column of this issue, the commission, after some preliminary correspondence, held its first meeting last week in New York. By unanimous resolution among the medical representatives, it was decided to recommend the Schaefer method exclusively for the use of laymen in practising artificial respiration on the unconscious shocked. The commission is now engaged in drawing up an official resuscitation chart giving detailed instructions for the restoration of the sufferers from accidental electric shock, which will be issued by the National Electric Light Association. It is a fortunate circumstance that the commission has decided definitely and unanimously between the two rival methods. The Schaefer method has, moreover, the great advantage, from the lay point of view, that it is much easier to learn and to maintain in operation than the Sylvester method. The latter is very laborious and wearisome, whereas the Schaefer method can be followed by any operator for an hour or more without sensible fatigue.

Judging from experiments reported by physiologists as made upon dogs, it seems doubtful whether artificial respiration can be of much avail if the heart of the subject has been set fibrillating. Nevertheless, there is always hope that patient research on animals may reveal some method of restoring the fibrillating heart. It is like the condition of a watch which has lost the beat of its hairspring and palettes, in some accidental mechanical shock. The mechanism of the watch may be all intact, but the hairspring and balance-wheel remain inert, making feeble little oscillations. In order to restore the watch to healthy activity it is necessary to arrest these little fibrillar oscillations and restore the healthy beat and full swing of the balance-wheel. It seems, however, that if the circulation stops completely for, say, only ten minutes, even if the heart can then be stopped fibrillating and started again in full swing, the vital centers may have suffered beyond restoration, within existing limits of human skill. It is for this reason that every effort should be made to obtain skilful medical aid immediately, when a person has lost consciousness from electric shock, so that in case the heart has been thrown out of its proper functions prompt steps may be taken to bring it back to normal operation. Aside from the more dangerous cases of interference with the heart-beat, that at present lie beyond the resources of bystanders, much benefit is likely to result from following a properly directed line of restorative treatment, and the electrical fraternity will await with interest the appearance of the commission's next publication on the subject.

FINAL READJUSTMENT OF INCANDESCENT LAMP BUSINESS.

For some time the manufacturers of incandescent lamps against whom suit was brought by the United States government have been working on a plan for the readjustment of the method of conduct of their business to conform with the provisions of the decree entered in the United States Circuit Court, Northern District of Ohio, Eastern Division, on Oct. 12, 1911.

This plan has been perfected and went into effect with the General Electric Company and the companies operating on licenses under its incandescent lamp patents on March 1, 1912. Under the new plan, incandescent lamps will be sold by the manufacturers without restriction as to re-sale prices. The manufacturers will, however, follow the policy of selling to consumers directly or through regularly appointed agents.

The properties of the constituent companies of the National Electric Lamp Company have been transferred to the General Electric Company, and those companies will hereafter conduct their business as a part of the General Electric Company. The personnel of the organization of the National Electric Lamp Company and of its constituent companies will not be disturbed, and the men to whose efforts the successful development of the business of the national companies is so largely due will continue their activities in directing the business hitherto in their charge.

The new schedules which went into effect on March 1 involve substantial reductions in the prices of metal filament lamps and of Gem lamps.

TUNGSTEN LAMP PATENT.

A patent was issued Feb. 27 to Alexander Just and Franz Hanaman, of Budapest, Hungary, on a tungsten lamp. This patent, for which application was filed July 6, 1905, and which is assigned to the General Electric Company, is a fundamental one on the tungsten lamp, as will be noted from the broad claims allowed. Following is a description of the process covered by the patent:

In order to produce filaments consisting of a mixture of tungsten and carbon, finely divided tungsten, or some tungsten compound which is readily reduced by carbon to a metal, such as tungsten oxide, tungstic acid, tungsten sulphide or the like, is mixed with an organic binding medium, such as solution of cellulose in chloride of zinc, collodion, coal tar, coal pitch or the like. The filaments are then formed by pressure in the usual manner and thereupon, or after a preceding denitration in case of applying collodion, these filaments are carbonized.

The proportions of the mixture should be determined in such a manner that in the finished filaments sufficient carbon is present to impart the requisite strength, as it is the carbon alone that imparts strength for withstanding the subsequent treatment. Thus, for example, efficient filaments are obtained if from 2 grams to 10 grams tungstic acid are added to a solution of 10 grams cellulose in 260 grams chloride of zinc of the specific weight of 1.83, this mixture being then formed into filaments and carbonized in absence of air. The filaments, which consist of a homogeneous mixture of carbon and tungsten and which are to be regarded as intermediate products, are then treated in such a way that the carbon is removed by chemical means.

This may be effected by submitting the filament to the action of an electric current and raising it to a high temperature in an atmosphere of steam and hydrogen. In this process the carbon, analogously to the water-gas process, is completely oxidized into carbonic oxide, and there remains a filament of tungsten. These filaments then may be equalized in a manner analogous to that employed in the treatment of ordinary carbon filaments, by submitting them to the action of a current in an atmosphere of volatile tungsten compounds in the presence of a considerable quantity of hydrogen, so that the tungsten deposited equalizes the filaments.

Tungsten filaments may also be manufactured in the following manner: As is already known, it is old to coat carbon filaments with tungsten by heating such filaments in the vapor of a halogen compound of this metal in the presence of a large quantity of hydrogen. The finest possible carbon filaments (of about 0.04 mm in diameter) are coated with a layer of sufficient thickness of the said metal and the filaments are then exposed in an atmosphere of neutral gases under the influence of an electric current to a high temperature, whereby in a few minutes the carbon contained in the core is dissolved by the metal surrounding it. This solution takes place owing to the fact that the free carbon is absorbed by the metal as carbide. A filament treated in this manner shows itself to be perfectly homogeneous if a point of fracture is submitted to microscopic inspection which affords proof that it no longer contains any carbon core. These filaments may now be readily freed from carbon as described above so that pure metal filaments are obtained.

The filaments produced according to this invention consist of dense coherent tungsten metal and have a high fusing point of approximately 3200 deg. C. and are capable of incandescent efficiency at the rate of less than 1 watt per cp, and are substantially free from perceptible disintegration at that efficiency, the light-emitting properties of the filaments being due to the coherent, homogeneous metallic nature of the tungsten. Following are the three claims of the patent :

"What we claim herein as new and desire to secure by letters patent is:

"A filament for incandescent lights consisting of tungsten in a coherent metallic state and homogeneous throughout.

"A filament for incandescent lights consisting throughout of substantially pure metallic tungsten of high fusing point and electrically conductive, the light-emitting properties of the filament being due to the coherent, homogeneous metallic nature of the tungsten.

"A filament for electric incandescent lights comprising dense, coherent tungsten metal, having its fusing point approximately 3200 deg. C. and capable of incandescent efficiency at the rate of less than 1 watt per cp and substantially free from perceptible disintegration at that efficiency."

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

At the meeting of the International Electrotechnical Commission held at Turin in September last three special committees were nominated to continue the study of nomenclature, symbols and the rating of electrical machinery respectively, and to draw up preliminary propositions which will be laid before the various local committees with a view to subsequent international agreement. These committees consist of one delegate each from the following countries:

Nomenclature.—France, Germany, Great Britain. Professor Larsen was specially invited to attend the meeting on nomenclature. In view of the growing importance of the Spanish language a member of the Spanish committee is invited to send a delegate to follow the work on nomenclature.

Symbols.—Belgium, France, Germany, Great Britain, Holland, Italy, Spain, Switzerland, United States.

Rating of Electrical Machinery.—Belgium, France, Germany, Great Britain, Italy, Sweden, Switzerland, United States.

Arrangements are being made for a meeting of these three special committees to be held toward the end of March, and, at the invitation of the French committee (president, Dr. R. V. Picou), they will take place in Paris. Following is a list of the delegates who will attend:

Country.	Nomenclature.	Symbols	Rating.
Belgium.....	.....	Prof. E. Gerard.	Prof. E. Gerard.
France.....	M. E. Brunswick.	M. Paul Janet.	M. P. Boucherot.
Germany.....	Dr. E. Budde.	Dr. K. Strecker.	Herr L. Schüler.
Great Britain..	Dr. Thompson.	Mr. L. A. LeGros.	Mr. A. Siemens.
Holland.....	.....	Dr. M. de Haas.	.....
Italy.....	.....	To be appointed.	To be appointed.
Spain.....	.....	Señor de la Peña.	.....
Sweden.....	.....	.....	To be appointed.
Switzerland..	.....	To be appointed.	Dr. Wyssling.
United States.	.....	Prof. C. A. Adams and Mr. C. O. Mailloux.	

RESUSCITATION FROM ELECTRIC SHOCK.

The first meeting of the Commission on Resuscitation from Electric Shock was held in the board room of the National Electric Light Association, New York City, on Feb. 22. As has previously been stated in these columns, this commission was recently organized upon the initiative of the National Electric Light Association, and has for a purpose the study of electric shock and the preparation of a set of rules for first aid in case of electrical accident. The commission is composed of members of the American Medical Association, National Electric Light Association and American Institute of Electrical Engineers, as follows:

Nominated by the American Medical Association: Dr. W. B. Cannon, professor of physiology, Harvard University, chairman; Dr. George W. Crile, professor of surgery, Western Reserve University; Dr. Yandell Henderson, professor of physiology, Yale University; Dr. S. J. Meltzer, Rockefeller Institute for Medical Research, New York; Mr. W. D. Weaver, editor *Electrical World,* secretary. *Nominated by National Electric Light Association:* Dr. E. A. Spitzka, professor of general anatomy, Jefferson Medical College; Mr. W. C. L. Eglin, electrical engineer, Philadelphia Electric Company. *Nominated by American Institute of Electrical Engineers:* Dr. Elihu Thomson, electrician, General Electric Company; Dr. A. E. Kennelly, professor of electrical engineering, Harvard University.

At the meeting in New York City the medical members of the commission unanimously advocated the Schaefer, or prone, method as the best means in the hands of laymen for maintaining respiration in victims of electric shock, and the commission formally voted to recommend this method. According to the Schaefer method, the patient is placed face downward, whereas according to the Sylvester method, which has heretofore been most used for artificial respiration, the patient is placed face upward. A chart is now being prepared which will give details of first aid in cases of electric accidents and will describe fully the method of applying artificial respiration. This chart will be issued under the auspices of the National Electric Light Association.

EXHIBIT ARRANGEMENTS FOR SEATTLE N.E.L.A. CONVENTION.

The exhibition committee has announced arrangements for the exhibits of Class D members at the thirty-fifth convention of the National Electric Light Association at Seattle, Wash., June 10 to 13 inclusive. The convention headquarters will be located in the State Armory, and the exhibits themselves will be placed in the drill hall. The exhibition area of 8150 sq. ft. has been divided up in such a way as to provide seventy booths of fair proportions.

Through the courtesy of the Seattle Electric Company, energy for the operation of exhibits and for lighting the armory will be furnished gratis. The circuit available is rated at 117-234 volts, 60 cycles, single-phase. The meeting rooms are arranged so that entrance and exit to and from them will require passage through the exhibition hall. One end of the exhibition hall will be cut off by a double partition, and in this section the principal sessions of the convention will be held.

Realizing the expense of shipping material from Eastern points, the committee has given attention to the matter of grouping and reshipping such material at Chicago in carload lots, thus securing a reduced tariff; but, in order to make this arrangement effective, it is necessary for the committee to know well in advance how much material will be shipped in this manner. Applicants for exhibition space are requested to indicate first, second and third choices of location, and allotments of space are scheduled to be made on March 15. The secretary of the exhibition committee is Mr. Walter Neumuller, 55 Duane Street, New York, and the chairman is Mr. J. C. McQuiston, Pittsburgh, Pa.

PLANS FOR BOSTON ELECTRIC SHOW OUTLINED.

Over 300 electrical men listened to an extended outline of the plans for the Boston 1912 Electric Show at the weekly gathering of the Luncheon Club branch of the New England Section of the National Electric Light Association at the American House, Boston, on Feb. 23, the speaker being Mr. Herbert W. Moses, manager of the show. Mr. Moses pointed out that the show is being planned under the auspices of the Edison Electric Illuminating Company of Boston for educational purposes, and that it is designed to be an international advertising proposition solely to familiarize people with the advantages, flexibility and economy of electricity for every kind of business and domestic use. Referring to the House of Edison Light, which the company placed in service about fifteen months ago at a first cost of about $10,000, Mr. Moses said that the results from this portable exhibit have increased business for wiring contractors and augmented the sales of electric appliances in many other central stations outside Boston as well as on the Edison system. At a cost of nearly $30,000 in the last seven months the company has been exploiting the electric-vehicle business, an amount merely incidental to what the company expended in establishing a public garage in Boston and is now spending in equipping its transportation department with an outfit of seventy electric vehicles. At an expense of about $15,000 a "Farm of Edison Light and Power" is now under construction, in the shape of a 110-ft. by 60-ft. tent containing about fifty electrically operated appliances specially adapted to farm service. During the summer this tent will be moved about the farming districts in the company's territory to stimulate interest in rural electrical applications throughout the 600 sq. miles which the company serves. All this work is only preliminary to the show itself, which the company intends to make the largest exhibit of electrical appliances ever brought together.

Two years of preliminary work and an obligation of $150,000 will be realities before the show opens, including a world-wide search for information, publicity work in foreign countries, co-operation with American consuls, and the study of causes of insufficient success in previous shows elsewhere. Extended use has been made of personal letters to central stations, about 30,000 having been sent out to date. Several million stickers have been prepared for advertising the show, and these have been approved by the Post Office Department for attachment on either side of an envelope. Newspaper publicity, posters and elaborate lighting effects will be features of the enterprise. Special railroad rates will probably be granted, and several conventions will meet at Boston during the period of the show,

which will be from Sept. 28 to Oct. 26. The opening will probably be a private view to members of the Fifth Congress of the International Chambers of Commerce, which will meet at Boston in September.

Mr. Moses exhibited a number of lantern slides of the decorative plans, which have been outlined in the *Electrical World* so far as ornamental illumination is concerned. The services of twenty-five men will be required for six months to paint the scenery, and 500 men working twenty-four hours per day will be required to erect the decorations in ten days, excluding wiring and arch construction. Twenty-one skeleton arches, containing about 20,000 incandescent lamps of 4-cp rating, with colored bulbs, will be used on Huntington Avenue, and the interior decorations will be artistic and installed on an unprecedented scale, covering every barren detail of the Mechanics' Building with a mantle of beauty. Outline lighting will be employed on all sides, particularly on façades of the building which can be seen from the principal electric and steam transportation routes passing through the Back Bay. About 500,000 kw-hr. will be required at the show.

STANDARDIZATION OF ELECTRIC-VEHICLE SPEEDS.

At the regular meeting of the Electric Vehicle Association of America held in New York Feb. 27 Mr. Alexander Churchward, of the General Electric Company, presented Part 2 of the report of the committee on standardization of the electric vehicle, the present section dealing with the speed of vehicles. Last year the committee reported on the standardization of voltages of various sizes and types of vehicles, and the chairman expressed gratification at the progress made, since nearly all vehicles for 1912 and 1913 will be equipped with batteries requiring a charging voltage of from 78 volts on the small pleasure or passenger cars to 110 volts on the various sizes of commercial vehicles and larger types of pleasure or passenger cars.

Mr. Churchward lamented the fact that, owing to the desire of salesmen to effect sales, the speed of the electric vehicle has been increased from year to year, notwithstanding the claims of simplicity, reliability and ease of operation made for the electric vehicle. He showed by numerous slides that the power requirements rise very rapidly after the speed of a vehicle has been increased over 17 to 18 miles an hour, due chiefly to windage. The following speeds for electric pleasure vehicles were suggested, after the author had a number of conferences with different manufacturers: Closed type coupé, 19 miles an hour with pneumatic tires and 18 miles an hour with solid cushion tires; open victoria type, 20 miles an hour with pneumatic tires and 19 miles an hour with solid cushion tires. The effect of high speed on the efficiency of commercial vehicles was pointed out by charts, and Mr. Churchward said that, in order to compete successfully with the horse, a 3-ton truck

Carrying Capacity.	Speed, Miles per Hour.
1000 lb.	12–13
2000 lb.	10–11
3000 lb.	10
2 tons	8– 9
3 tons	7– 8
4 tons	6.5–7.5
5 tons	6– 7
6 tons	6.5

did not have to run at touring-car speeds. A speed of 7½ miles an hour on a truck of this type would enable it to compete very successfully with the horse-drawn vehicle and would result in low maintenance costs. A compilation of the speeds of various vehicles was given as above.

The author concluded with a plea to keep the maximum speeds of electric vehicles down to such a point that the vehicle will continue to hold the enviable position it does to-day for cheapness and reliability for city work and short hauls. A general discussion of the paper followed its presentation, in which Messrs. R. M. Lloyd, William F. Kennedy, C. Ward, R. Cilley, T. H. Schoepf and R. L. Lloyd took part. All complimented the author on the paper, and voiced the desirability of possessing a complete series of the curves shown by Mr. Churchward on the screen. President Blood announced that Mr. Churchward would publish the curves after they had been copyrighted, and would add to them, so that all of his investigations would be available to the membership.

PROGRAMS OF CONVENTIONS DURING MINNEAPOLIS ELECTRIC SHOW.

Conventions of the Minnesota Section, American Institute of Electrical Engineers, the Minnesota Electrical Association and the Minnesota Electrical Contractors' Association, and a rejuvenation of the Sons of Jove, will be held during the week of the Minneapolis Electric Show, March 16 to 23, in the Minneapolis Armory. The Institute sessions open Monday afternoon, March 18, with papers by Messrs. W. D'A. Ryan, Schenectady, N. Y., *Lighting, from the Early Ages to the Present,* and Arthur L. Abbott, St. Paul, *Illumination Problems.* On Tuesday, "central station day," Mr. H. B. Gear, Chicago, will present a paper on *Central Station Distribution,* and Mr. E. H. Schofield, Minneapolis, will discuss *Power Station Economies.* An elaborate banquet will be held at the Hotel Radisson Tuesday evening, at which Mr. Ralph W. Pope, honorary secretary of the Institute, will be a guest. Mr. Charles L. Pillsbury, consulting engineer, is president of the local Institute section, and Mr. L. H. Cooper is secretary.

The fifth annual convention of the Minnesota Electrical Association (whose membership includes the Dakotas) will begin Wednesday morning, March 20, with papers by Mr. E. Jackson, St. Paul, *Oil and Other Internal Combustion Engines,* and Mr. R. E. Brown, Mankato, *Increasing Revenue in Small Towns.* On Thursday morning Mr. Norman Macbeth, Bloomfield, N. J., will discuss *Competitive Illuminants,* and Mr. C. G. Edwards, Albert Lea, *Accounting.* Friday's program includes papers by Mr. William Coles, Warren, Ohio, *Mazda Versus Gas, Gasoline and Arc Street Lighting,* and Mr. S. H. Conkey, Minneapolis, *Electric Vehicles.* Mr. Ludwig Kemper, Albert Lea, is president of the Minnesota association, and Mr. E. T. Street, Consumers' Power Company, St. Paul, is secretary. For Thursday afternoon an inspection trip by electric automobiles to the Minneapolis General Electric Company's generating stations is planned, followed by the Minnesota association banquet at the Hotel Radisson and a rejuvenation of the Sons of Jove at the armory. Nearly 100 exhibitors will make displays at the Minneapolis Electric Show, which opens Saturday afternoon, March 16, and continues during the following week.

Proposed New York State Hydroelectric System.

The Conservation Commission of New York State has had introduced into the Legislature a bill providing for immediate state construction, control and maintenance of a state-wide system of electrical transmission, including water-storage reservoirs constructed by the State for public use and benefit. Under the provisions of the bill, the commission will have power to lease, purchase or condemn the property necessary for the undertaking and may contract to furnish municipalities with water and electrical energy

for the purpose of lighting public streets and private buildings. The water-powers developed along the line of the Barge Canal are put under the jurisdiction of the commission, which is also authorized to contract with riparian or other owners benefited by the regulation of the flow of any stream "at a rate not less than $20 a year for each foot of fall available for 1,000,000,000 cu. ft. of created or increased storage capacity of a dam or dams." This bill is offered as a substitute for the water-storage bill recently introduced by Senator Ferris, said to meet the approval of present power owners, which provided for a quasi-public corporation.

WINNIPEG LOSES IN CONTEST WITH PRIVATE ELECTRICAL INTERESTS.

The Privy Council at London has decided in favor of the Winnipeg Electric Railway Company in a case on appeal involving the interests of that company. According to the decision, the railway company, which also owns the electric lighting company, can transmit power to the city from its plants outside and can retain its distributing system within the city. On the strength of favorable decisions in lower courts, the city invested $6,000,000 in a municipal plant, and the property of the railway and lighting company is valued at $25,000,000, the plant outside of the city and the city distributing system being valued at $6,000,000.

The litigation between the Winnipeg Electric Railway Company and the city of Winnipeg began in 1906, when the city entered action in the Court of King's Bench of Manitoba, claiming that the company had no right to use, for the operation of the street railway system, any power that was not developed within the city limits, and that the use of power generated outside the city was in violation of the provisions in the charter and invalidated the franchise of the company. The city also claimed that the company had failed to fulfil the condition of the charter in respect of the operation, conduct and management of the street railway system. The further claim was made by the city that the company had no right to place poles or wires upon the city's streets for the transmission of power generated outside of the city, and the city asked that the company be ordered by the court to remove such wires and poles and forbidden to erect any more.

This claim was made as a protest against the absorption of a number of smaller companies, to which the city had granted lighting, power and heating franchises, by the street railway company, as the city had not given consent to the sale of these franchises to the street railway company by the individual companies to which the various charters had been granted in the first place.

The judgment of the Court of King's Bench was partly a victory for the city and partly a victory for the company, the greater advantage being with the city. The case was carried to the Manitoba Court of Appeal, which sustained the findings of the Court of King's Bench. By agreement the appeal from the Manitoba Court of Appeal was carried direct to the Privy Council in England, skipping the Supreme Court at Ottawa.

Briefly, the decisions of the Manitoba courts which were appealed against were:

(1) That the company has no right or title to erect poles or wires on the city's streets for the transmission of electricity for any other purpose than street-car operation.

(2) That the company must remove from the city's streets all poles and wires for the transmission of electricity for any other purpose than street-car operation.

Against these decisions the street-car company appealed to the Privy Council in England.

The third decision of the Manitoba court, which was "that the bringing in of electrical current from the company's plant at Lac du Bonnet does not invalidate the company's franchise, as the current so brought in is like fuel brought in for use in the company's steam plant, the transforming of electrical energy so brought in being the development within the city of the power used for street-car operation," was the only decision which went against the city, as the company argued that the power was produced at Lac du Bonnet, where the company's power plant on the Winnipeg River is situated, and therefore not manufactured in the city, as the defense argued.

The decision gave the company authority to operate a street-railway service, but cut it off from supplying power and light to the citizens. The company at once appealed from the decision denying its right to erect poles and string wires for commercial purposes, and the city filed a cross appeal against the decision which gave the company the right to generate power for its cars outside the city. It was on this issue that the Privy Council found completely for the company.

The litigation was so heated that it caused Mackenzie & Mann to offer to sell their entire plant to the city for $24,000,000, which was refused. The city invested $6,000,000 in a great civic hydroelectric plant and cut the rates of the company from 10 cents to 3 cents per kw-hour. It is now believed that the city will buy the street-railway company's entire interests.

CHICAGO SUBWAY SITUATION.

A proposal for an elaborate system of subways entirely independent of all present transportation systems was submitted to the local transportation committee of the City Council of Chicago by the city harbor and subway commission under date of Feb. 19, "on the advice of the Mayor." A few months ago the commission submitted a tentative plan for subways in the "downtown" district only, these subways to cost something less than $10,000,000 and to be used by the existing elevated and surface railways. The use of the subways in this manner is intimately connected with the proposed consolidation of the existing local transportation systems of Chicago. Such a consolidation, to receive sanction from the city, involves a valuation of the elevated railway properties, the valuation of the surface lines being fixed by the traction settlement ordinances of 1907. There has been some delay in making this elevated railway valuation, but inventories, practically complete, were placed in the hands of the subway commissioners on Feb. 1. Some time will elapse before a report thereon can be made, and in the meantime the Mayor has directed the commission to outline a plan for an entirely independent system of subways.

The proposed "independent" subways are an extension of the formerly proposed subways in the "downtown" district and consist of four radiating lines extending several miles from the central district—on the north in North Clark Street and other streets to the corner of Evanston Avenue and Lawrence Avenue; on the northwest in Milwaukee Avenue and other streets to Monticello and Grand Avenues; on the southwest in Harrison Street, Blue Island Avenue and other streets to West Fortieth Avenue and Twelfth Street; on the south in State Street to Sixty-third Street. Four-track subways are proposed, and the estimated cost of the system is $103,200,000, of which $11,400,000 is put down to electrical equipment. If, on the other hand, it is desired to construct only the downtown subways, but to operate them in conjunction with the elevated railways, instead of leasing the bare subways, the cost is estimated at $44,700,000, including $20,000,000 for rolling stock and $8,000,000 for electrical feeders. Apparently, the purchase of electrical energy is under contemplation in either case.

PROVIDENCE (R. I.) POWER SITUATION

At a recent meeting of the special committee on lighting franchises of the Providence (R. I.) City Council, Mr. Arthur B. Lisle, general manager of the Narragansett Electric Lighting Company, appeared in opposition to the admission of the New England Power Company to the Providence market. The latter organization controls the hydroelectric plants and systems in operation and projected in the Connecticut and Deerfield River Valleys, with generating stations at Vernon, Vt., and in the Shelburne Falls district, and recently applied for authority to supply electrical energy on a large scale in Providence over a transmission line to be built through the Blackstone Valley southward from Worcester.

Mr. Lisle disclaimed any intention to oppose the entrance of any service which in his opinion would be an economic benefit to the community, but argued that the existing market for the New England company's output is so large within its immediate plant radius as to leave no additional capacity for distribution in Rhode Island. He pointed out that within two years about 50,000 hp will be developed and in service on the system of the New England company, and contended that within 55 miles of the latter's generating plants 184,000 hp is now being developed by rail-hauled coal. He urged that with tidewater coal the Providence company cannot afford to purchase energy from the New England hydroelectric system even at the prices offered, and also criticised the reliability of the hydroelectric service as compared with energy supplied from central-station steam plants. He said that the liability of a shutdown from anchor ice is greater than of a stoppage of output from a coal strike, and pointed out the difficulties of regulation and need of auxiliary steam power in the operation of hydroelectric systems.

ELECTRICAL MUSIC BEFORE NEW YORK ELECTRICAL SOCIETY.

The 308th meeting of the New York Electrical Society, held in the Chapter Room, Carnegie Hall, was attended by a most appreciative and enthusiastic audience, more than 300 people being present. The subject of the evening was "Electric Music: Its Present and Future." Dr. Thaddeus Cahill, the well-known pioneer in the development of this music, gave a lucid description of what the music is, how it is produced, its advantages and its possibilities. Dr. Cahill stated that there were radical improvements pending which would raise the character of electric music immeasurably. He hopes within the next few months to be able to secure "string" tones in the music, and this will practically revolutionize its character and add very greatly to its charm and power. An illustrative program was played at the telharmonium factory at Fifty-sixth Street and Tenth Avenue by Messrs. Paul W. Fishbaugh and Franklin Harris, and brought over telephone wire to the meeting-room. The wire-transmitted music, played at a distance, was also used as an accompaniment to song. Madame Mira Fischer-Zarad gave several selections, and her exquisite singing brought down the house. The society is to be congratulated on the most successful example of the visiting meetings which have become such a popular feature of its programs. In the unavoidable absence of the president, Mr. John Bottomley, Mr. C. O. Mailloux presided and his lucid opening remarks on the relation of the work of Helmholtz and others to the accomplishment of actual results in telharmonium music were as happy as they were effective. Mr. Mailloux spoke of electrical music as a thing beside which wireless telegraphy was simple. He also maintained that electrical music promised more to the world in the way of happiness than did any other electrical development of the present time.

REFLECTORS AND ILLUMINATION.

At a meeting of the Chicago Section of the Illuminating Engineering Society, Feb. 22, Messrs. A. J. Sweet and L. C. Doane, of Newark, Ohio, presented a paper on "The Choice of Reflector, and Its Influence on Illumination Efficiency and Depression in Visual Function," first read at the New York meeting of the Society, Feb. 8, and abstracted in our issue of Feb. 24.

Mr. J. R. Cravath, Chicago, opened the discussion with complimentary comment on the thoroughness of the investigation reported in the paper. The results obtained with the small room there studied, he pointed out, might, however, differ, giving higher efficiencies in cases of larger rooms with smaller ratios of wall area to total wall and ceiling surface. Mr. Cravath also indorsed the statement in the paper as to the mistake of using flat reflectors, and to the fallacy of expecting high reflective efficiency from light-opal glassware of the numerous makes now common, whose use, he declared, should be confined mainly to such transmission purposes as inclosing balls, plates, etc. Quoting the authors' statement that the loss in illumination efficiency due to dark walls is fully offset by the resulting gain in visual efficiency, Mr. Cravath said the converse would be correspondingly true. He suggested extending such investigations to a study of diffused shadows, pointing out that, while there are actually shadows or areas of reduced illuminated intensity with indirect lighting, their lack of sharp outline makes them hardly noticeable. In commenting on the conditions of the authors' tests, the speaker observed that the horizontal line of vision there adopted does not correspond to ordinary working positions when writing or reading, but office work is done under so many widely varying conditions that some standard must be adopted for sake of reference.

Mr. T. H. Aldrich, Chicago, put a number of questions regarding details of the tests, and testified to the superior comfort and reduced fatigue with which office work can be done under indirect lighting. Any glassware in Chicago offices, he declared, must be cleaned about twice a month for efficient operation, the loss in light and labor required each being about identical for either direct or indirect systems. Utilitarian reasons, he pointed out, usually dictate dark-colored wall tints up to a chair-board or "dado" line about 40 in. above the floor level, thus incidentally improving visual efficiency.

Mr. F. H. Vaughn, Milwaukee, spoke with praise of the definite, practical data contained in the paper, and related his efforts to conserve school children's vision through selection of proper lighting fixtures, wall colors and mat-surface unglazed book papers. Certain educators have gone so far as to abolish halftones in schoolbooks, in order to avoid the glossy paper required, although such a step, said Mr. Vaughn, unnecessarily deprives the pupil of a valuable means of instruction through attractive, truthful illustrations. Mr. Frank Brice, Chicago, advised against attempting to mix daylight with artificial illumination, and Prof. G. S. Barrows observed that such difficulties as are found may in part be due to the eye's best visual acuity with monochromatic light.

In closing the discussion, the author of the paper, Mr. Sweet, remarked the revolution in social conditions during the last fifty years which has so greatly increased the use of the human eye beyond the service formerly required of it. With the visual organs thus overloaded, every possible effort should be made to minimize the strain to which they are subjected. Careful tests were made of the subjects used in his investigations, said Mr. Sweet, and all abnormal or unconsciously prejudiced observers were eliminated. Careful watch was also kept for fatigue, although none was noted. In placing the lamps and reflectors all possible pains were taken to gain an equitable comparison of the various units, although it is evident that no varia-

tions in the test conditions can affect the final result. Depression in visual function, said Mr. Sweet, occurs from light surfaces within an angle of 25 deg. on each side of the center of vision, so that dark wall tints below the chairboard dado line would not eliminate this trouble unless the dark tints were carried higher.

Mr. A. J. Morgan presided as chairman of the meeting, and Messrs. J. R. Cravath, T. H. Aldrich and J. W. Foster were elected members of the Chicago Section board of managers, in accordance with a recent by-law increasing the number of section managers from two to five. Mr. Cravath was also appointed on the general committee on section developement and Mr. Aldrich was made chairman of the Chicago membership committee.

ELECTRICAL SYMBOLS FOR MINE MAPS.

In a paper recently presented before the Mining Institute of America Mr. H. H. Clark, of the United States Bureau of Mines, described a list of electrical symbols adopted by that bureau for use in reporting mine examinations. In preparing the list of symbols certain characters, he said, were included which in the past have been quite generally used in electrical diagrams. As many of the National Electrical Contractors' symbols were used as seemed applicable, and the rest of the list consists of more or less arbitrary forms.

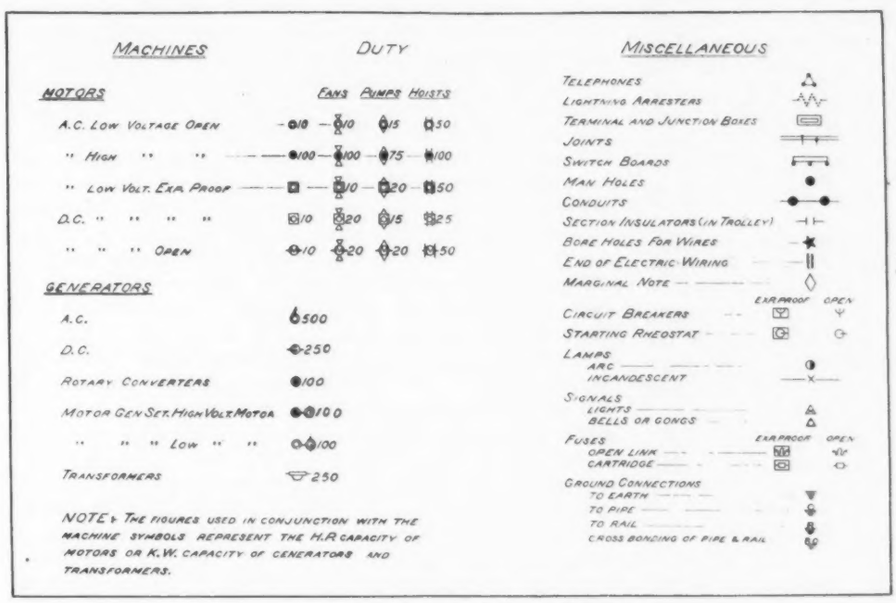

Fig. 1—Electrical Symbols for Mine Maps.

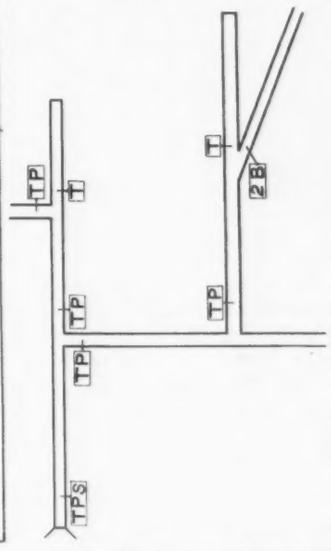

Fig. 3—Application of Symbols.

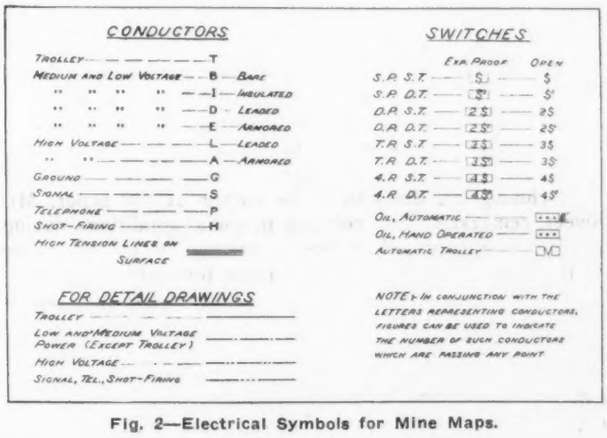

Fig. 2—Electrical Symbols for Mine Maps.

Letters are used to indicate conductors; thus "T" denotes a trolley wire, "B" a bare low-voltage conductor, etc. Figures are used in conjunction with the letters to denote the number of conductors of any kind. Thus "2T" denotes two trolley wires and "3B" denotes three bare conductors. Other kinds of circuits are denoted by other letters. These letters are placed on the map along the side of an entry to show what circuits are passing through that entry. Whenever a conductor is added or dropped a new symbol is put on the map at the proper place, showing one more or one less letter as the case may be.

Figs. 1 and 2 show the various symbols, and Fig. 3 indicates the manner of their use. The letters show that a trolley line, a telephone line and a signal line all enter the pit mouth. All these lines run down the main entry as far as the first right face. The trolley and telephone lines run down the first right-face entry as far as the first left-butt entry. They turn in there and continue as far as the cross-cut entry, where the telephone line is dropped, the trolley line continuing down the butt entry. The symbol "2B" shows that two bare wires run up the cross-cut. The symbol "T-P" shows that the signal line is dropped just beyond the first face entry, but that the trolley and telephone lines continue as far as the symbol "T," which shows that beyond this point on the main entry there is nothing but trolley wire. The symbol "T-P" on the first left-face entry shows that both the trolley and the telephone lines run up this entry.

Cleveland Municipal Plant.

The City Council of Cleveland, Ohio, has authorized the sale of $1,000,000 municipal light bonds. Director of Public Service Springborn informed the Council that as soon as the money is available plans for the proposed plant will be completed and bids for the machinery will be asked. A few days later City Solicitor Wilcox rendered an opinion that, since the people had authorized this issue of bonds by vote, it is not subject to the Crosser law, which provides that the issue must be held for sixty days to allow a referendum petition to be filed. City Auditor Coughlin followed this with the announcement that the city will ad-

vertise for the sale of the bonds at once. Bids will be received on April 8.

It has been decided to erect the municipal light plant on the west side of East Fifty-third Street, just north of Lakeside Avenue, in close proximity to the water-works pumping station. The building will be 150 ft. by 175 ft. ground dimensions and between 50 ft. and 60 ft. high, according to the size of the equipment designed to go into it. It will be of substantial construction and no attempt will be made to have it built to accord with the group plan structures. An aqueduct 500 ft. long and 5 ft. in diameter will be built to convey water from the water-works tunnel for use in the condensers.

PUBLIC SERVICE COMMISSION NEWS.

MARYLAND COMMISSION.

The Public Service Commission has asked the Consolidated Gas, Electric Light & Power Company to submit a brief statement showing how it intends to spend the money derived from the proposed sale of a portion of the $840,000 general-mortgage 4½ per cent bonds and the $1,500,000 of common stock which the commission has authorized. The company has requested the commission to allow it to rearrange proceeds of a portion of the bond and stock issue, as it has changed its plans somewhat since the application was made. The company agreed to submit its plans in detail, and in the meantime the question is being held under consideration by the commission.

The Magothy Improvement Association has asked the commission to make a physical valuation and examination of the Maryland Electric Railway, which operates between Baltimore and Annapolis. The commission is also asked to determine if the capitalization is excessive or not, if the operation and management are economic, and if the road is being conducted with due regard to the stock and bond holders. It is contended by the association that the charges made by the road between the two cities give undue and unreasonable preference to patrons using stations near Baltimore and Annapolis over those using stations along the middle section of the road.

WISCONSIN COMMISSION.

The commission has granted the application of the Superior Water, Light & Power Company for permission to put into effect a modification of Rule 17, which relates to electric service and provides that all electric meters must be tested at least once a year. By this modification the company will adopt a schedule which will vary the frequency of testing the meters according to the income from each meter, with the expectation that a higher degree of meter accuracy will result. The commission has recognized the fact that a distinction might properly be made between meters of varying types, sizes or earning capacities in the matter of the frequency of the required periodic tests, but which factor or factors should govern in the interval between tests is not immediately apparent from the information at hand.

The commission's order provides that the Superior Water, Light & Power Company shall be exempt from testing all latest types of induction meters at least once each year, provided the following schedule is adopted: Approved late type of induction lighting meters with annual revenue of $60 or less, at least once every eighteen months; all types of lighting meters with annual revenue of $60 to $180, at least once every twelve months; all types of lighting meters with annual revenue of $180 to $360, at least once every six months; all types of lighting meters with annual revenue of $360 or over, at least once every three months; induction-type power meters, once every six months; commutator-type power meters, once every three months. The order provides further that wherever a meter is found to register outside the requirements established by the commission when tested on the above schedule it shall be shifted to the next class and tested more frequently except where the cause of incorrect registration is unquestionably due to some special disturbing influence which is not likely to occur again. The commission is willing that the above scheme should be tried thoroughly, but has reserved the right to recall the order when sufficient data may be collected to show that the modification is unsatisfactory or unreasonable.

The hearing has been held on the application of the village of West Salem for a certificate of convenience and necessity relative to the establishment of a second electric utility or, as an alternative, an order for the enlargement and re-equipment of the existing utility and the improvement of its service. From the testimony of a considerable number of witnesses it was evident that the service has been grossly inadequate for a number of years especially in the matter of voltage regulation. These contentions were borne out by the tests made by the engineering staff, which showed that at the time of the complaint the maximum voltage did not exceed 85 per cent of normal voltage and that it was impossible to maintain normal voltage at the time of peak load. These faults were subsequently remedied by the engineering staff, but the voltage regulation since that time has seldom been within the limits prescribed by law. The contention that a day power service was necessary was not substantiated at the hearing. The present system is a 133-cycle, two-phase system and not very well adapted to power service. The present condition of affairs in West Salem is due as much perhaps to the antagonistic attitude and the unreasonable requests of the village board as to the quality of service rendered by the defendant. The commission has taken the matter under advisement and will render a decision later.

A hearing on the complaint against the rules, service and regulations of the Southern Wisconsin Railway Company in the city of Madison was heard recently before Commissioner Roemer. A large number of witnesses were examined by the complainant to show that the service was inadequate during the rush hours and that certain of the company's regulations and rules were unreasonable. Dudley Montgomery, vice-president and superintendent of the company, appearing on behalf of the defendant, introduced statistical evidence compiled from tests recently made upon the system to show that the overcrowded condition of the cars was not as serious as alleged by the petitioner. It was furthermore claimed by the company that its present practice of running extra cars during the periods of heavy travel would to a large degree obviate the trouble if the public would but co-operate with it by making proper use of the extra cars. No determination of the issue will be made by the commission until its engineers have made a careful survey of the entire situation and a study of the facts as they find them.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has granted authority to the Adirondack Electric Power Corporation, which has taken over various electric companies generating power on the upper Hudson River, to issue common capital stock to the amount of $9,500,000, preferred stock to the amount of $2,500,000 and fifty-year 5 per cent gold bonds to the amount of $5,000,000. This is the first reorganization case decided by the commission since the decision of the Court of Appeals in the Third Avenue Railway case, which interpreted the law limiting the supervision of the commission over reorganizations.

Up to the rendering of this decision, the commission says in an opinion accompanying its order, it "has uniformly held in reorganization cases that a reorganized corporation should come to us upon precisely the same footing as any

other corporation in the matter of an issue of stock and bonds. It has acted upon this principle in various cases with excellent results, uniformly holding that an issue of stocks and bonds must bear a proper relation to the value of property for which they were issued. "This view of the law was overturned by the Court of Appeals in the Third Avenue case, and we see no escape from the conclusion that this determination of the Court of Appeals is binding upon this commission so far as the amount of the securities to be issued is concerned, and we are unable to perceive how it is possible for us to act upon the rule which we have hitherto believed to be the correct one, that securities should not be issued except they bore a proper and definite relation to the value of the property which they represented."

The commission further states under the law as it now stands it has no power except in two particulars, namely, to determine whether the applicant is, in fact, a corporation duly incorporated pursuant to the laws of the State under the stock corporation law, and entitled to all the rights flowing from such incorporation, and to determine that the securities of the reorganization are not in excess of the valid outstanding securities of its predecessor. The commission remarks that the later provision allows the reorganization of an insolvent corporation to water the stock and bonds up to the amount that the stock and bonds of the former corporations were watered, but no more. As to the present application, the commission says:

"We have not found ourselves able to inquire into the value of the properties involved by reason of the decision in the Third Avenue case. No evidence has been submitted to us concerning the value of such properties. We are entirely unable to say what such value is, and it is but just to the commission that it should be of record that it makes the decision in this case authorizing the capitalization proposed by the plan of reorganization without reference to the value of the property to be taken over by the new corporation solely because the law compels it to make such decision."

The new corporation is a reorganization of the Hudson River Water Power Company, Hudson River Power Transmission Company, Saratoga Gas, Electric Light & Power Company, Hudson River Electric Company, Hudson River Electric Power Company, Madison County Gas & Electric Company and Empire State Power Company.

ONTARIO HYDRO-ELECTRIC COMMISSION.

A bill has been introduced in the Ontario Legislature by the Hon. Adam Beck giving wider powers to the Ontario Hydro-Electric Commission. Under the bill the commission may appropriate any lands or water-powers for the construction of dams, canals, raceways, etc., and power is given to flood adjoining lands that may be deemed necessary for the purpose of storing power. Authority is given to the commission to develop water-powers for the use of private industries and to acquire the plant of any company in a municipality that has entered into an agreement with the commission for the supply of electricity, and to transfer the same to the municipality. Power is given to make regulations for the equipment, plant, etc., of electric railway, light and power transmission companies, and to see that such regulations are enforced; power is also given to order improvements, alterations, etc., in any electrical plant where such changes are considered necessary for the protection of the public.

A provision requires that the rates charged by any municipal corporation shall be subject to the approval and control of the commission, as well as the rates of any private company receiving power from the commission. Authority is given to establish a uniform system of bookkeeping, and to require telegraph, telephone, electric-light and other electrical companies to remove their poles and wires from the streets of any municipality and place them in underground conduits, to be constructed and maintained according to the directions of the commission. If a municipality constructs an underground system, other private companies may be required by the commission to make use of it.

The municipalities having relations with the Hydro-Electric Commission have organized the Ontario Municipal Electric Association, of which Mayor G. R. Geary, of Toronto, was elected president. The chief object of the new organization is co-operation in all hydroelectric matters, the purchase of supplies, standardization of equipments, accounts, operation and general management of plants. The association will also work in conjunction with the Hydro-Electric Commission to promote electrical development in the Province of Ontario. The body has petitioned the Hydro-Electric Commission to prepare a standard system of rates to be used by all municipalities. A resolution was adopted commending the Hon. Adam Beck for his efforts on behalf of the people of the Province, and recommending that he should be remunerated for his work of the past year, and provision is made for an adequate annual salary in the future for the chairman of the Hydro-Electric Commission.

Current News and Notes.

CONVENTION OF THE MISSISSIPPI ELECTRIC ASSOCIATION.—The Mississippi Electric Association (geographical section of the N. E. L. A.) will hold its fourth annual convention at Vicksburg, Miss., May 21-22-23. The following topics have been selected for consideration: Mixed and low-pressure turbines up to 750 kw; induction motors; distributing transformers; car construction; grounding of secondaries; coal, hand and mechanically fired.

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ENGINEERING SOCIETY OF WISCONSIN.—The fourth annual meeting of the Engineering Society of Wisconsin was held in Madison, Wis., on Feb. 14, 15 and 16. Nearly all the papers had to do with civil-engineering subjects. One exception was the paper of Mr. F. A. Vaughn, of Milwaukee, on "Relations of Modern Electric Meter Practice to Consumer, State Commissions and Central Stations." Mr. P. H. Connolly, city engineer of Racine, Wis., was elected president.

* * *

MEETING OF EMPIRE STATE ASSOCIATION.—A meeting of the Empire State Gas & Electric Association will be held at the Masonic Temple, Poughkeepsie, N. Y., at 10:30 a. m. on March 6. The general subject of the discussion will be "New-Business Methods." The following specific topics will be discussed: Advertising; solicitors' meetings; stunts for developing new business; appliance bargain sales; co-operation with architects, dealers and contractors; advantages and disadvantages of putting salesmen on a commission basis; wiring and piping old houses. The committee on arrangements for the meeting is composed of Messrs. H. W. Peck, M. G. Kennedy and G. T. Macbeth.

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TAX ON POLES UPHELD.—The Supreme Court of Illinois has handed down an opinion holding that cities in that State have the right to tax the poles of telegraph, telephone and other public-utility corporations. The case was one in which judgment had been entered in the Sangamon County Circuit Court in favor of the city of Springfield, Ill., against the Postal Telegraph-Cable Company. The Appellate Court sustained the judgment of the lower court, and the case was brought into the Supreme Court on a certificate of importance. The defendant company contended that the act was in conflict with the old post-road laws of the United States and also with the interstate commerce law.

N. E. L. A. Membership.—The membership of the National Electric Light Association has now reached 10,800, and it is expected that this number will be extended to 12,000 at the time of the Seattle convention. The company membership consists now of over 1000 central-station systems and holding companies, representing practically 1500 central stations in all.

* * *

Convention of the Canadian Electrical Association.—The next annual convention of the Canadian Electrical Association will be held in the city of Ottawa, Ont., June 19-20-21. President A. A. Dion is general superintendent and chief engineer of the Ottawa Electric Company so that entertainment features will not be lacking and the magnificent hotel recently erected by the Grand Trunk Railway will afford accommodations second to none in the country.

* * *

Awards of Elliott Cresson Medals.—The Franklin Institute, acting through its committee on science and the arts, recently awarded the Elliott Cresson gold medal, the highest in the gift of the Institute, to the following gentlemen: Dr. Alexander Graham Bell; Dr. S. W. Stratton, director of the United States Bureau of Standards; Dr. Albert A. Michelson, of the University of Chicago; Dr. Alfred Noble, C. E., past-president American Society of Civil Engineers; Dr. Elihu Thomson; Dr. E. W. Morley; Dr. Johann Friedrich Adolph von Baeyer, of Munich, Germany; Sir William Crookes, of London, England; Sir Henry Enfield Roscoe, of London, England.

* * *

St. Louis Rejuvenation, Sons of Jove.—Twenty-seven candidates, among whom was Mr. Alfred C. Einstein, president of the Union Electric Light & Power Company, were initiated at the rejuvenation of the Sons of Jove conducted in St. Louis on the evening of Feb. 23. This is the second rejuvenation held in St. Louis in less than a year. The interest aroused by Statesman Louis F. Philo's campaign for new members is expected to result in more initiations soon. The initiatory ceremonies were conducted in the Elks' Club following a banquet at which there was much sprightly oratory. Past Jupiter S. A. Hobson was chairman of the gathering in the banquet hall and toastmaster during the banquet. Tenth Mercury Ell C. Bennett in an address to the Jovians and candidates took for his subject the progress and the serious purpose of the order. He called attention to the formation of Jovian leagues in a dozen of the principal cities of the North, East, South and West, and to the active participation of Jovians in the establishment of electrical pages in leading daily newspapers. Statesman-at-Large Charles L. Martin, of Dallas, Tex., was a guest and speaker at the banquet. He gave the first news of the organization of a luncheon club in Galveston, and declared that this was the first of several like clubs which are to be established in other cities of his State. Speeches were made also by Messrs. Charles L. Brackett, George E. Cullinan, F. D. Phillips and L. S. Hunt.

* * *

Philadelphia Electric Company Section of the N. E. L. A.—The meetings held by the various departmental branches of the Philadelphia Electric Company Section of the National Electric Light Association during the month of February were as follows: The meter department branch met on Feb. 8 and discussed distribution problems. Mr. Harold Goodwin, Jr., took up the subject of the Philadelphia Electric Company's practice covering primary and secondary systems of alternating-current distribution, and Mr. Frank Humphreys covered the construction of underground systems, devoting particular attention to methods of making bends in conduit, conduit joints, shapes of manholes, etc. An exhibition of appliances, as well as practical demonstrations, made both talks doubly instructive. The general section meeting was held on Feb. 19 and was addressed by Mr. L. A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, who spoke on modern methods of securing efficiency in organizations. Mr. Osborne contended that permanent individual efficiency can only be attained by giving careful and constant thought to the mental and physical conditions of the individual and to husbanding and developing physical resources in order to meet the ever-increasing demand of modern business. At the commercial branch meeting on Feb. 26 Mr. A. L. Atmore read a paper on the development of personality as a factor in general success.

* * *

St. Louis League of Electrical Interests.—The weekly luncheons of the St. Louis League of Electrical Interests continue to be marked by enthusiasm and excellent attendance. That of Feb. 20 drew an audience of seventy-five representative electrical men. President Sam A. Hobson was in the chair and introduced Mr. W. E. Keily, associate editor of the *Electrical World*, who complimented the society on its work and referred briefly to similar undertakings in other cities, particularly in Chicago. The speaker of the day was Mr. Albert J. Marshall, of New York, manager of the architectural department of the Holophane Company, whose subject was "Scientific Illumination from an Architectural Viewpoint." Mr. Marshall, in the course of his remarks, said that every interior, however commonplace, should have fixtures in harmony with it. He made a plea for individuality in lighting equipment. Much attention has been paid to uniformity, to secure efficiency, and now the pendulum seems to be swinging in the direction of suitability to environment, with efficiency possibly a secondary consideration. The word "efficiency" is often misused; in lighting what is meant is "visualized efficiency." Mr. Marshall finished his lecture by urging the claims of the Illuminating Engineering Society on his hearers. At the close of the meeting the practicality of the league was shown when President Hobson appointed Messrs. Spoehrer, Claude Matthews and Humphrey a committee to urge the claims of St. Louis in the matter of the location of a Southwest distributing warehouse of the Westinghouse Electric & Manufacturing Company.

* * *

Brooklyn Edison Company Entertains Contractors.—The annual dinner given by the Edison Electric Illuminating Company of Brooklyn to the electrical contractors of Brooklyn was held at the Union League Club on Feb. 24. The dinner was preceded by a reception lasting half an hour, during which time there was a general commingling of central-station men and contractors. During the course of the dinner a number of popular songs were sung and souvenirs were distributed. Mr. T. I. Jones acted as toastmaster, and prior to introducing the speakers of the evening stated that during the year 2714 buildings were wired in Brooklyn and that 297 old buildings were wired at an approximate cost of $18,000, the work for which was solicited and obtained by the sales force of the Brooklyn Edison company and turned over to the local wiring contractors for execution. Payment for this work was guaranteed by the Edison company, and in fact the greater part of the money was paid outright by the company to the contractor on the completion of the work, the company recovering from the consumer on a deferred payment plan. The list of speakers and their topics were as follows: Mr. George Wiederman (local contractor), "The Contractor"; Mr. Milo R. Maltbie (Public Service Commissioner, First District), "The Public Service Commission"; Mr. L. H. Pounds (Commissioner of Public Works), "The Borough of Brooklyn," and Mr. W. W. Freeman (vice-president and general manager of the Brooklyn Edison company), "The Edison Company." Approximately 200 contractors and other guests of the company were in attendance, and the gathering and general feeling displayed indicated the close and cordial relations maintained by the company with the men engaged in electrical contracting work.

MICHIGAN ASSOCIATION CONVENTION CRUISE.—As noted in these columns Feb. 3, the Michigan Section of the National Electric Light Association will hold its annual convention on board the steamship *Majestic,* sailing from Port Huron Friday, June 21, for a five-day cruise through Lake Huron, Georgian Bay, the Thirty Thousand Islands and the St. Mary's River, to the "Soo" and Mackinac Islands, returning to Port Huron, Tuesday, June 25. The cost of this trip has now been fixed as $30 per person, including berth and meals. Reservations may be made at once from the secretary of the section, Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich .

* * *

MINER'S ELECTRIC HEADLAMP WITH FIREDAMP ALARM.—The property by which platinum occludes gas of several hundred times its own volume, increasing its temperature, is taken advantage of in a new safety electric lamp for miners. The lamp filament is supplied with energy from a small battery, the circuit including a thermostat contact placed in juxtaposition with a piece of platinum. If such a lantern is brought into a chamber containing a dangerous percentage of "firedamp" gas, the platinum heats rapidly, causing the thermostat to extinguish or dim the lamp. In one form of the device operation of the thermostat introduces a resistance path, dimming the lamp by a fixed amount so that it is no longer useful for work but gives light enough for the miner to find his way out. The lamp cannot be turned on full again except by an official at the mouth of the mine.

* * *

BOSTON A. I. E. E. SECTION VISITS POWER STATION.—About 250 members and guests of the Boston Section of the American Institute of Electrical Engineers visited the new South Boston power station of the Boston Elevated Railway Company on Feb. 24 at the latter's invitation. Five special cars provided by the courtesy of the company also conveyed the party to the Kendall Square substation in Cambridge, after which a special trip through the Cambridge subway was made by a train placed at the disposal of the company's guests. The subway extends from Harvard Square to Park Street, Boston, and will be opened to traffic in the near future, reducing the running time between the terminal points from about twenty-five to eight minutes. The party also visited the Harvard Square station, which is probably the largest subway transfer station in the world, and later inspected the new repair shops and yards at Eliot Square.

* * *

THE ELECTRIC COMMERCIAL VEHICLE.—A recent paper on the electric vehicle refers to the following "fleets" of electric commercial vehicles: Tiffany & Company, of New York, who have twenty-one electric vehicles, some of which have been in use for nearly ten years; the Anheuser-Busch Brewing Company, which has over fifty electric trucks, many long past the childhood age; Peter Doelger Brewing Company, with an equipment of forty-eight vehicles and the finest reinforced-concrete electric garage in the world; Jacob Ruppert Brewing Company, operating some seventy-two electric vehicles; R. H. Macy & Company, with thirty-eight electric machines; the Adams Express Company, with a hundred or two; the American Express Company, which has bought a hundred or more electric conveyances in the past six months. Reference is also made to the War Department's purchases of "electrics" for the Philippine Islands, and those for the navy yards, which are being equipped with the electric truck.

* * *

MINNEAPOLIS ELECTRIC CLUB BANQUET.—Two hundred electrical men from the twin cities of Minneapolis and St. Paul attended the fifth annual banquet of the Minneapolis Electric Club at the West Hotel, Minneapolis, Feb. 19. Miniature plaster casts of the Minneapolis tungsten-lamp curb standards lighted the tables, which, to exemplify the idea further, were arranged after the order of the downtown streets. Seated at the head table were Messrs. F. C. Dustin, president of the club; H. J. Gille, toastmaster of the evening; Guy See, James G. Houghton, Emil Anderson, C. L. Pillsbury, Robert W. Clark, F. W. Bell, F. D. Varnum and A. W. Leonard. A feature of the souvenir menu card was President Dustin's parody entitled "The Psalm of Light," adapting Longfellow's admonition to the purposes of the club's slogan, "Electrify Minneapolis." The banquet arrangements were in charge of a committee composed of Messrs. Gille, Emil Anderson, F. O. Wallene, M. T. Moss, Vice-president W. H. Vilett and Secretary-Treasurer C. W. Arrick.

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BOSTON ELECTRIC VEHICLE CLUB.—The weekly meeting of the Electric Vehicle Club of Boston was held at the Edison Building on Feb. 21, with Vice-president E. S. Mansfield in the chair. Following the usual luncheon a short discussion of advertising matters took place, after which brief addresses were made by representatives of electric-vehicle manufacturing interests from outside New England. Mr. W. C. Johnson, of the Waverley Company, Indianapolis, Ind., said that the Boston electric-vehicle campaign has influenced his directors in planning their business expansion, and cited the increase of orders for electric equipments for Australia, Japan and Porto Rico which followed the establishment of a foreign department six months ago. Within the past four months this company has done the largest business in its history, and no evidence of dull times is forthcoming within its organization. A valuable point in stimulating new electric-vehicle business is the policy of taking old cars as assets in selling new vehicles, on the same principle as cashing in the value of second-hand pianos in the musical instrument trade. Mr. J. R. Kinsey, of the Lansden Company, Newark, N. J., said that the outlook for the electric vehicle is better than ever. A new factory is being opened by his company in Newark, and the 1912 electric wagon is from 12 to 15 per cent better than its predecessors. He concurred in the policy of making allowances for second-hand electric vehicles, in order to keep the applications up to the highest possible standard of efficiency.

* * *

REDUCTION OF RATES IN CHICAGO.—Announcement is made of a pending reduction in the price of electrical energy by the Commonwealth Edison Company of Chicago. On all bills computed from meter readings taken on and after April 1, 1912, the net primary rate will be 10 cents a kw-hr. instead of 11 cents as at present. Another reduction will be made on Oct. 1 next, when the secondary rate will be reduced from 6 cents to 5 cents. This company has an interesting and rather remarkable record in reducing rates. In 1898 the rates were 20 cents for the primary portion of the bill and 10 cents for the secondary rate. At that time also forty-five hours' use of the maximum was required in a month before the secondary rate was earned. A few years later the maximum-hours requirement was reduced from forty-five to thirty, which is the present figure. Thereafter came successive reductions as follows, the figures being the primary and secondary rates : 1905, 16 and 10; 1906, 14 and 9; 1907, 14 and 8; 1908, 12 and 7; 1909, 12 and 6; 1911, 11 and 6; April 1, 1912, 10 and 6; Oct. 1, 1912, 10 and 5. Thus in a period of fourteen years the rates will have been cut in half exactly. The results have been made possible by reductions in cost of production due to the advancement of the art and bold and skilful engineering and to enlarging the market by the wholesaling of electricity to large consumers and modern methods of selling, building up a better load factor. During this period of constantly declining rates the net earnings of the company have increased steadily, showing that the policy adopted has been one of mutual benefit to the consumers and to the producer.

The Kansas Gas, Water, Electric Light & Street Railway Association.—The annual meeting of the Kansas Gas, Water, Electric Light & Street Railway Association will be held Oct. 17-19, 1912, at Manhattan, Kan. Mr. James D. Nicholson, Newton, Kan., is secretary.

* * *

Pittsburgh Section, Illuminating Engineering Society.—The former Pittsburgh (Pa.) Section of the Illuminating Engineering Society, first organized several years ago, was revived Feb. 13 at a meeting of the society's members in Pittsburgh, when it was decided to extend membership eligibility in the section to members in Cleveland and Newark, Ohio. A section membership of nearly ninety will be obtained in this way.

* * *

Railroad Telegraph and Telephone Competition.—The Louisville & Nashville Railroad Company will, it is reported, soon commence installing its own system of telephone and telegraph connections along its numerous Southern divisions, and solicit general commercial business in competition with the Western Union and the American Telephone & Telegraph Company. The contract between the Western Union and the Louisville & Nashville for telegraph service in the latter's territory expired in August, and the officials of the railroad company refused to renew it, purposing to install and maintain service of their own.

* * *

Abnormal Wind Velocity.—Designers and builders of aerial electrical circuits and electric signs may be somewhat surprised to learn of the velocity reached by the wind in New York City during a recent storm. In the past forty years, during which government records have been kept of the wind velocity in New York, a velocity as high as 83 miles was recorded on only one former occasion, April 7, 1909. On Feb. 22, 1912, the instantaneous velocity reached 110 miles per hour, while a velocity exceeding 96 miles per hour was sustained for more than five minutes. Many of the signs and aerial circuits were damaged, as was to be expected under such abnormal conditions.

* * *

Chattanooga Electrical Exhibition.—Chattanooga, Tenn., proposes to present a mammoth electrical exposition next November. A stock company with $50,000 capital is now being formed to back the enterprise, and it is proposed to make Chattanooga the center of the electrical world of the United States for a time, as soon as electrical service begins from the Ocoee lock and dam at Parkersville, from the Hale's Bar lock and dam at Hale's Bar and from the Georgia Power Company's lock and dam, at Tallulah Falls, Ga. The output of these three stations, aggregating 300,000 hp, will be at the disposal of Chattanooga in the very near future and will be commemorated by the proposed exhibition.

* * *

Electric Vehicles Unaffected by Blizzard.—Through Chicago's blizzard of Feb. 21, and in the teeth of a snow-filled gale blowing 50 miles an hour, the four electric omnibuses operating between the railroad stations and the store of Carson, Pirie, Scott & Company made their regular schedule unaffected, while hundreds of gasoline automobiles and trucks were overwhelmed by the high wind and deep snow drifts, and left abandoned. The storage-battery trucks made fifty round trips on that day, carrying 800 people, the largest number for any day during the four weeks they have been in service. An account of these Field omnibuses using Edison batteries was given on page 210 of our issue for Jan. 27, 1912.

* * *

Prime Movers Committee, N. E. L. A.—A meeting of the National Electric Light Association's committee on prime movers was held on Feb. 19 in St. Louis with Mr. Hunter, the St. Louis member of the committee. Attention was devoted to the drafting of the report to be presented at the Seattle convention, and on Feb. 20 the committee inspected the great hydroelectric development of the Mississippi River Power Company now in course of construction at Keokuk, Ia. Especial attention will be paid to water-power development in the forthcoming report. There were present Messrs. I. E. Moultrop (chairman), Boston; W. N. Ryerson, Duluth; W. L. Abbott, Chicago; John B. Klumpp, Philadelphia; Edwin D. Dreyfus, Pittsburgh; R. S. Kelsch, Montreal, and John Hunter, St. Louis.

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Iowa Electrical Association Convention.—In connection with the 1912 convention of the Iowa Electrical Association, to be held in Des Moines on April 24 and 25, an electric show will be held beginning on April 23 and ending April 26. Both the convention and the show will be held in the Coliseum Building, which is well suited for the purpose. There will be reports of committees on the grounding of secondaries, street and curb lighting, central-station facts and factors, and affiliation with the National Electric Light Association. The following papers have been assigned: "Building Up a Day Load for Small Central Stations," "Central-Station Heating by Hot Water and Steam," "Representative Motor Installations in Iowa," "High-Pressure and Low-Pressure Steam Turbines," "Boiler-Room Economies," and "The Care of Consumers' Meters." The secretary of the association is Mr. A. W. Zahm, Mason City. The chairman of the committee on arrangements for the show is Mr. W. H. Thompson, manager of the Des Moines Electric Company.

* * *

American Electric Railway Association.—The 1912 convention of the American Electric Railway Association will be held in Chicago on Oct. 7-11. The decision as to place was reached after a thorough study of the whole situation by a committee on convention location authorized at the recent meeting of the executive committee, and consisting of Mr. Thomas N. McCarter, president; Mr. C. L. Henry, fourth vice-president, and the secretary, with the assistance of a similar committee from the allied Manufacturers' Association, as follows : Messrs. W. L. Conwell, president; C. S. Hawley, A. H. Sisson, Edwin H. Baker and James H. McGraw, vice-presidents; H. C. Evans, and George Keegan, secretary. The committee personally inspected the facilities available in the cities of Milwaukee and Chicago, and in addition gave due consideration to the cordial invitations extended to the association by the cities of Los Angeles, Chattanooga, Buffalo, New York and Atlantic City. It was thought that the Middle West is the proper place for the 1912 convention in view of the fact that the last two conventions have been held in the East.

* * *

Safety Devices in Manufacturing Plants.—The safety committee of the Association of Iron and Steel Electrical Engineers has announced that it will, without charge, inspect manufacturing plants and make suggestions for the installation of safety appliances. Chairman L. R. Palmer, in a letter to manufacturers, says that the committee of the association has at hand considerable data collected from the various plant organizations, both at conventions and during trips of inspection to many of the largest and best equipped plants of the country, and that if any manufacturer wishes to place before the association any of his safety problems, the committee will gladly co-operate to improve the safety conditions. There are, he says, among the active members some of the foremost electrical engineers of the land, whose experience is invaluable from a theoretical and practical standpoint in deciding such safety questions as are directly connected with the electrical field of the industry. An associate membership has recently been started which will include many of the safety inspectors and engineers connected with the independent plants as well as those plants under control of the United States Steel Corporation.

A COMBINATION LIGHTING, HEATING AND ICE PLANT AT LOUISVILLE, KY.

The 700-kw Station of the Fetter Heating & Lighting Company an Example of Modern Practice in Combination-Plant Operation.

AN electric-lighting plant which in winter converts its exhaust steam into district-heating service and in summer applies the same exhaust to ice manufacture reaches well into the highest commercial—if not technical—efficiency possible with combination operation. Such a station is the new 700-kw direct-current plant of the Fetter Lighting & Heating Company, Louisville, Ky., which furnishes electrical energy for lighting and motors in the business district of the city, supplies steam heat for nearby buildings, manufactures 60 tons of ice daily and provides refrigeration for its own cold storage and for the iceboxes of hotels and restaurants in its district. Although the plant is not large as modern central stations go, it embodies a number of features of the most up-to-date practice in combination-plant operation and duplicates in many ways the problem presented by the small central station which contemplates expanding into by-product fields.

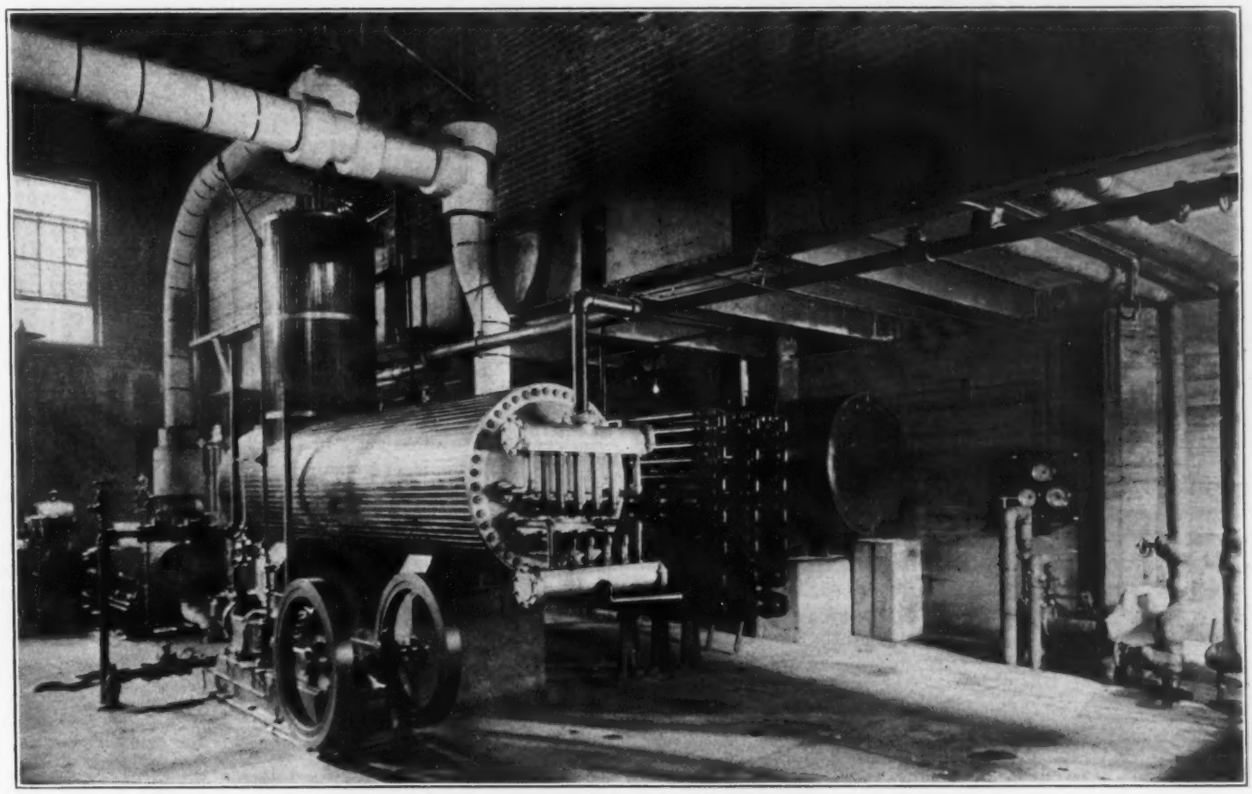


Fig. 1—Aqua-Ammonia Pump, Generator, Exchanger and Absorber in Engine Room.

STEAM AND ELECTRICAL EQUIPMENT.

The Fetter plant is located in the commercial center of Louisville, one square distant from the Ohio River. Coal hauled in by wagons is unloaded outside the building into narrow-gage cars, the tracks of which extend to a platform elevator. With this elevator the loaded cars can be hoisted to the bunker level, where they are run off on to the industrial railway above the coal bins. The same elevator is also extended down to the ash-basement level so that cars loaded with ashes can be elevated to a track shelf at the boiler-room level, 10 ft. above the ground. This track shelf extends out over the wagon-loading space, enabling ashes to be discharged directly into the wagons. The present novel provision for coal and ash handling has proved very useful at the Fetter plant.

To guard against floods due to possible high water in the Ohio River the boiler-room and engine-room floors have been elevated well above the street level. The steaming equipment consists of three 250-hp Stirling boilers furnishing steam at 150-lb. pressure. The 220-volt direct-current generating equipment comprises one 300-kw Westinghouse machine, direct-driven by a Ridgway four-valve engine; a 200-kw similar unit driven by a Ridgway tandem-compound engine, and two 100-kw units driven by McEwen simple engines. All of the prime-mover equipment is operated non-condensing, at a back-pressure of 3 lb. per square inch, exhausting into the steam-heating mains in winter and furnishing energy for ice manufacture by the absorption process in summer. Since the electrical output has chiefly the characteristics of a power-load, without aggravated evening peak, the engine exhaust can be used effectively to supply low-pressure heating with the minimum addition of live steam through the automatic valves. A system of underground tunnels and conduit mains radiating from the station conveys the several utilities produced by the Fetter plant to the buildings which it serves.

ABSORPTION-TYPE REFRIGERATING MACHINERY.

Present seasonable interest, of course, attaches to the combination ice-making equipment installed in this station, which produces an average of 60 tons of ice per day during the summer season, besides providing 15 tons of refrigeration daily for the cold-storage rooms in the plant. The machine installed is of the ammonia absorption type built by the Carbondale Machine Company, and, although rated at but 50 tons daily, this nominal capacity has, as above explained, been regularly exceeded when it is desirable to push the output. Exhaust steam from the prime-mover engines furnishes both the distilled water for ice making and also the energy to liquefy the ammonia which is afterward expanded in the freezing tank to extract heat from the water in converting it into ice.

In the engine-room on the lower floor are installed the ammonia "generator" or boiler, the exchanger, the aqua-ammonia pump and the absorber, all parts of the refrigerating equipment. Exhaust steam at a pressure of 2 to 3 lb. per square inch gage is admitted to the coils of the circulating system. The entire water supply of the plant is thus passed through this condenser, entering it at about 57 deg. and leaving at about 68 deg., and to the copious and effective cooling action thus provided is attributed the economy of this installation.

FETTER LIGHTING & HEATING COMPANY DAILY RECORD, JUNE 16, 1911.

Time.	TEMPERATURES.			PRESSURES.				PUMP DISPLACEMENTS.			
				Generator.							
	Brine in Freezing Tank.	Water from Condenser.	Water from Absorber.	Steam.	Ammonia.	Absorber.	Boiler.	Brine Pump, 10 in. x 6 in. 10 in.	Well Pumps, 10 in. x 36 in.	Aqua-Ammonia Pump. 6.5 in. x 8 in.	Cans Filled.
7.30 a.m.	11.5	68	79	3.0	124	12	140	27	64	38	
8.30 a.m.	11.5	68	80	3.0	125	12	148	27	68	36	
9.30 a.m.	11.5	68	81	2.7	124	12	150	27	68	38	
10.30 a.m.	11.5	68	80	2.5	125	12	137	27	68	36	
11.30 a.m.	12.0	68	80	2.5	121	12	144	26½	66	38	
12.30 p.m.	12.0	68	80	2.5	129	12	140	26½	68	38	
1.30 p.m.	11.7	68	80	2.5	125	12	148	26½	68	33	
2.30 p.m.	11.5	69	82	2.7	127	12	144	26½	68	36	
3.30 p.m.	11.5	69	80	2.0	125	12	142	27	70	35	
4.30 p.m.	11.5	68	79	1.7	124	12	145	27	67	38	
5.30 p.m.	11.7	68	79	1.5	125	11	125	27	60	35	
6.30 p.m.	11.7	68	79	2.5	130	11½	140	27	60	36	196
7.30 p.m.	11.7	68	79	2.5	130	11½	135	27	60	36	Day Shift
8.30 p.m.	11.5	68	79	2.2	130	11	140	27	62	36	
9.30 p.m.	11.0	68	79	2.3	130	11	140	27	62	37	
10.30 p.m.	10.5	68	79	2.5	134	10	135	27	62	35	
11.30 p.m.	10.0	68	79	2.5	135	10	130	27	62	35	Commenced feeding heavy to raise temperature and prevent cracking.
12.30 a.m.	10.0	68	79	2.5	135	9	140	27	60	36	
1.30 a.m.	11.0	68	79	2.0	120	10	115	27	58	34	
2.30 a.m.	11.5	68	79	2.0	120	11	125	27	58	35	
3.30 a.m.	12.0	67	80	2.5	121	11½	140	27	60	36	
4.30 a.m.	12.0	67	80	2.0	122	11¾	140	27	60	36	
5.30 a.m.	12.5	68	79	2.3	120	11¾	140	27	60	36	
6.30 a.m.	13.5	68	78½	2.3	120	12	148	27	71½	39	200

Ice made, 59 tons 800 lb.; 396 300-lb. cakes.

the generator seen in the foreground of Fig. 1, and these serve to "boil" the aqua-ammonia solution, to which its heat is imparted through the coil walls. This "boiling" liberates the ammonia gas from its solvent water, driving the gas up into the roof-top condenser (Fig. 2) at a pressure of 120 lb. to 135 lb. per square inch. Here the cooling effect provided by circulating well water through the pipes of the condenser converts the compressed ammonia gas into liquid anhydrous ammonia. The roof-top condenser is made up of ten stands of 1.25-in. and 2-in. pipes, each stand 10 pipes high. The ammonia occupies the annular space between the two pipes, well water at an initial temperature of about 57 deg. Fahr. being circulated through the smaller pipe within. In the Fetter condenser the water circulation system is divided into halves, which are operated in parallel from double supply headers, to reduce the friction head of

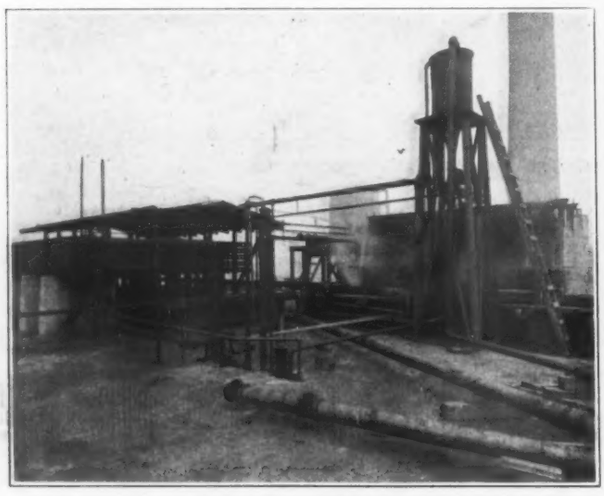


Fig. 2—Rectifier and Condensers Established on Roof of Plant Building.

FREEZING TANKS.

Two freezing tanks, each containing 357 300-lb. cans, are installed on the second floor, directly over the engine-room. Between the rows of cans in the brine of the tanks are inserted the ammonia expansion lines, each stand 6 pipes high. Into these expansion pipes is admitted the liquid anhydrous ammonia from the condenser. Here, under the decreased pressure, the ammonia vaporizes, extracting heat from the brine (ordinarily held at 10 deg. to 14 deg. F.), and so in turn from the cans with their distilled-water contents. The expansion coils are operated on the flooded principle; that is, an excess of liquid ammonia is kept in the coils so that their interior surfaces are always "wetted" with ammonia liquor, improving the transmission of heat to the expanding ammonia gas. At the rear of the freezing tank in Fig. 3 is seen one of the frost-covered accumulators

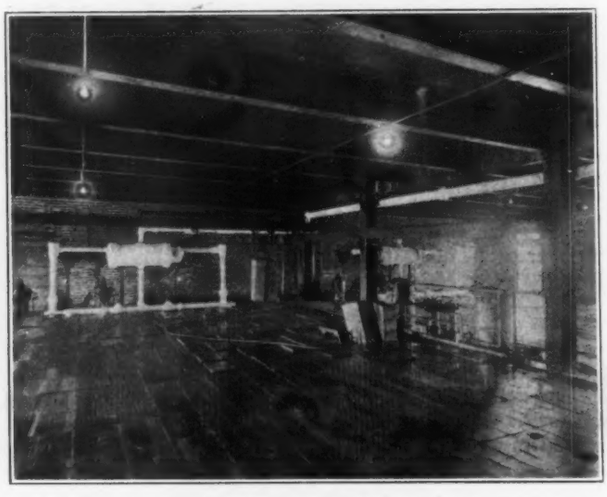


Fig. 3—Freezing Tanks, Showing Motor-Driven Brine Agitators, Accumulators, Etc.

which separate the liquid ammonia from the expanded gas leaving the expansion coils and return the liquid to maintain the flooded-coil system. Rapid and thorough circulation of the brine within the can tanks is assured by four 3-hp motor-driven agitator propellers, two to each tank and each running at 1000 r. p. m.

From the expansion line the nearly spent ammonia gas passes through the forecooling tank, where it reduces (to about 38 deg. Fahr.) the temperature of the distilled water later used for filling the cans. Returning to the first floor, the now expanded ammonia gas, at a pressure of about 15 lb. per square inch, is vigorously drawn into solution in the weak aqua liquor contained in the absorber. This absorber is seen alongside the generator in Fig. 1, and the delivery of this weak aqua from the latter to the former is effected automatically by the difference in the pressures (125 lb. and 15 lb. respectively) in the two vessels. In passing over, the weak liquor is also partly cooled in an open-pipe exchanger which puts its heat to efficient use.

Considerable heat is again liberated, as the weak liquor dissolves several hundred times its volume of ammonia gas. To convey away this heat and to reduce the absorber temperature to a point most effective for solution to take place the circulating water from the roof-top condenser is also passed through the absorber. The cooling action effected here is about the same in extent as in the roof-top condenser, the water undergoing a temperature rise from about 68 deg. to 79 deg. Fahr., or about 11 deg., as before. After absorbing several hundred times its volume in ammonia gas in the absorber, the aqua ammonia solution is then returned by the 6½-in. by 8-in. steam-driven aqua pump (seen in the foreground of Fig. 1) to the generator, there to recommence its cycle above described. In the absorption type of machine the "absorber" function is thus seen to correspond to the suction stroke in the compression cycle, while the "generator" provides the compression-stroke function.

A little more than one-half of the distilled water required for ice making by this process is supplied by the condensate coming from the generator coils, since approximately 55 lb. of steam per hour at 3-lb. pressure is required to boil the ammonia for making 1 ton of ice in twenty-four hours. The other half of the distilled water supply is furnished by condensing exhaust steam directly in roof condensers, adding this water to that obtained after doing useful work in the refrigeration-plant generator. In the Fetter plant the aqua-ammonia pump and the well pump providing condensing water are now operated by steam, but may later be converted to motor drive. Were these auxiliaries motor-driven, the total energy consumption of the auxiliary machinery, including well pumps, brine agitators, etc., would average, it is believed, about 10 kw-hr. per ton of ice produced. Brine for refrigerating the cold storage room is at present circulated from the freezing tank by a 10-in. by 6-in. by 10-in. steam pump. Two Cook 10-in. by 36-in. steam-driven deep-well pumps provide the water supply for the station.

During the season of 1911, when the Fetter plant began its first-year's operation, 60 tons to 62 tons of ice were pulled daily, besides the supply of 15 tons of equivalent refrigeration to the cold-storage compartments. Although the nominal rating of the equipment is but 50 tons, a shell-type brine cooler is to be added during the present season for refrigerating brine which will be circulated through the cold boxes of nearby hotels and restaurants. During the month of July, 1911, it is of interest to add that the cost of coal burned for producing both ice and electricity totaled $1,200, while the return from the ice alone, as sold at a low rate on the plant platform, was $4,000.

Mr. George G. Fetter is president of the Fetter Lighting & Heating Company. Mr. J. H. Cochran is general manager and supervised the layout of the mechanical features of the new plant.

INDUSTRIAL ELECTRIC SERVICE IN THE SOUTHERN STATES.

11,000-Volt Lines of the Mobile Electric Company and the Motor Equipment of Two Large Industrial Concerns Connected Thereto.

By A. D. Quackenbush.

In reaching out after some of the large industrial establishments located in the environs of Mobile, Ala., the Mobile Electric Company found it expedient to erect 11,000-volt lines from the power house to connect up a number of factories having a load of over 1100 hp. The motor equipment of two of these establishments is described

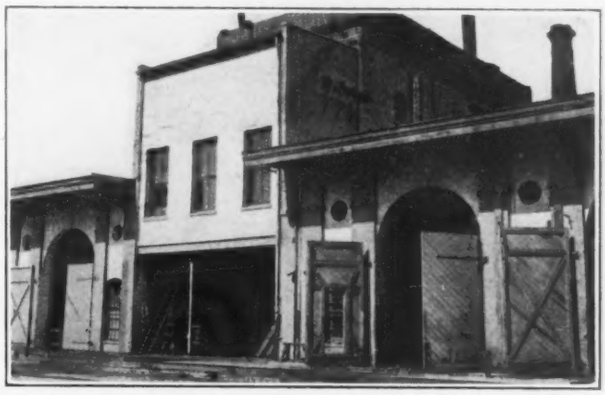


Fig. 1—Substation, Whistler, Ala.

in detail herewith as well as the construction of the 11,000-volt lines over which the energy is transmitted.

THE 11,000-VOLT LINE.

There are two distinct 11,000-volt lines leaving the power house, one going to Whistler and the other to the Dauphin Lumber Company. The former consists of three No. 3 medium hard-drawn copper wires, which are insulated within the city and bare outside the city limits. These wires are spaced on 30-in. centers, in the form of an inverted triangle, and are mounted on the same side of the pole on 4-in. by 5-in. cross-arms. This construction allows a duplicate line to be built on the other side of the pole and leaves the top of the pole vacant for a ground wire. The pole line runs along the Mobile & Ohio Railroad right-of-way. Much difficulty was encountered in setting some of the poles owing to the swamps. Many poles had to be set in barrels and had to have four poles used as braces to keep

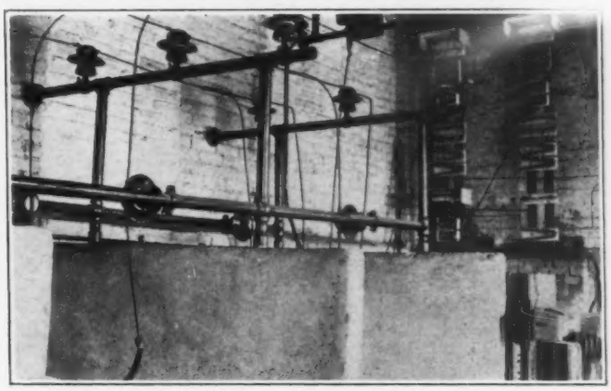


Fig. 2—High-Tension Bus, Whistler Substation.

them afloat. All poles are juniper; cross-arms are of long-leaf yellow pine; pins within the city are of locust and outside the city are of oak.

In the early spring many of the oak pins began to break

off, causing the insulators to turn upside down on the cross-arm. The pins broke off just inside the inner petticoat of the insulators. The wood looked rotten and was in a rather spongy condition, but not charred. The locust pins

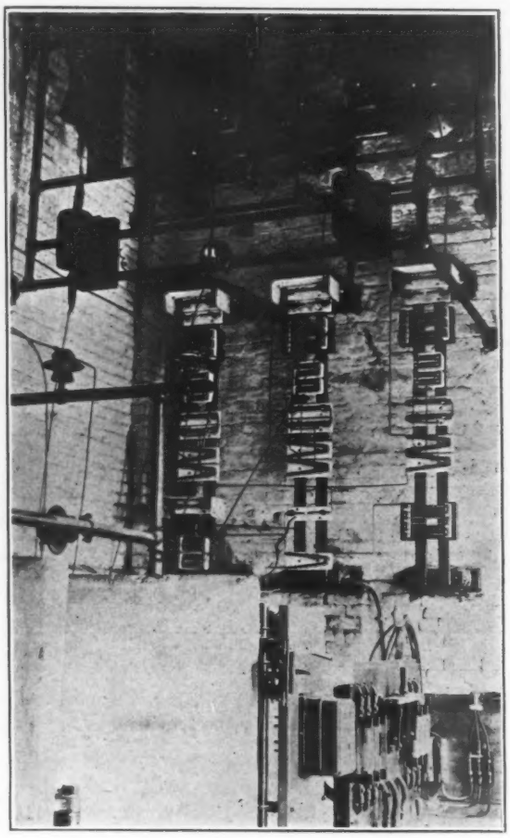


Fig. 3—Lightning Arresters in Whistler Substation.

were in perfect condition. In order to prevent any more trouble from these pins, they were sawed off and galvanized-iron bracket pins which clamp around the arms were installed in the same position as the former pins. As the work had to be done on Sundays, the expense of installing these pins amounted to 22 cents each.

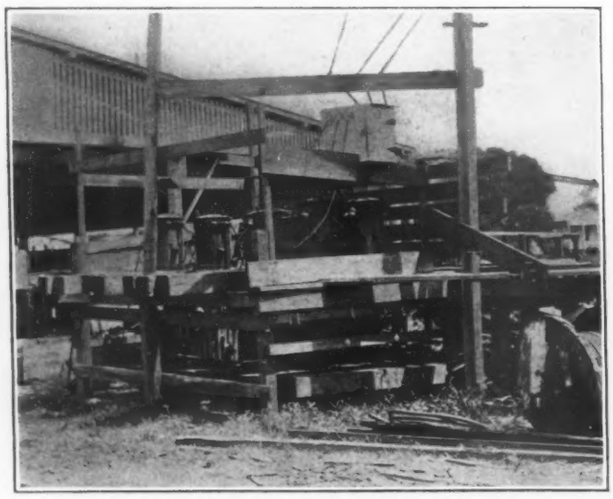


Fig. 4—Temporary Transformers for Dauphin Lumber Company.

The electrical storms around Mobile are frequent and the lightning is severe, but the lightning arresters at each end of the line have proved very efficient. Many times the resistance rods of the arresters have broken, and only once has the circuit been knocked out. One of the poles had the entire top knocked off by lightning. On a portion of the line about a mile long a No. 4 galvanized-steel wire has been strung on the top of the pole for a guard wire.

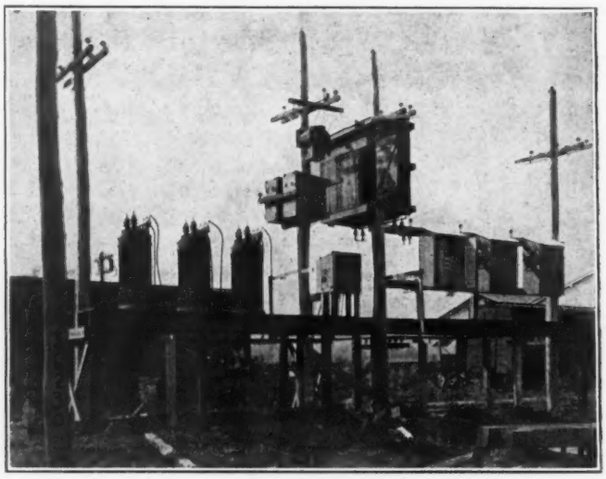


Fig. 5—Substation for the Dauphin Lumber Company.

Whether this has any advantage on this particular line is open to discussion.

About 3 miles from the power house the first branch line taps the main line through disconnecting switches. This line is about half a mile long, and has four 40-kw transformers connected to it. Three 40-kw transformers were installed for the Mobile abattoir, which has a connected load of 67½ hp. These transformers are mounted on a wood platform between poles and are protected by General Electric 11,000-volt fuses. The single 40-kw transformer steps the voltage down from 11,000 to 2300 and is used to furnish a primary energy for the lighting of Pritchard.

The next branch line is about three-fourths of a mile long and furnishes two power consumers. The first one has three 40-kw transformers installed on a platform and operates a planing mill; the second installation consists of three 10-kw transformers on a pole. It operates a stave mill.

The third branch taps the line in Whistler and operates

Fig. 6—View of Transmission Line Near Whistler.

a chair factory about a mile distant. The installation consists of three 50-kw transformers protected by Westinghouse high-tension fuses and mounted on a platform between two poles. The total connected load is 145 hp.

The line going to the Dauphin Lumber Company consists of three No. 6 medium hard-drawn copper wires mounted on porcelain insulators, all on the same arm. The one-arm construction was used because of its cheaper first cost. Should a duplicate line ever be built, then a second arm can

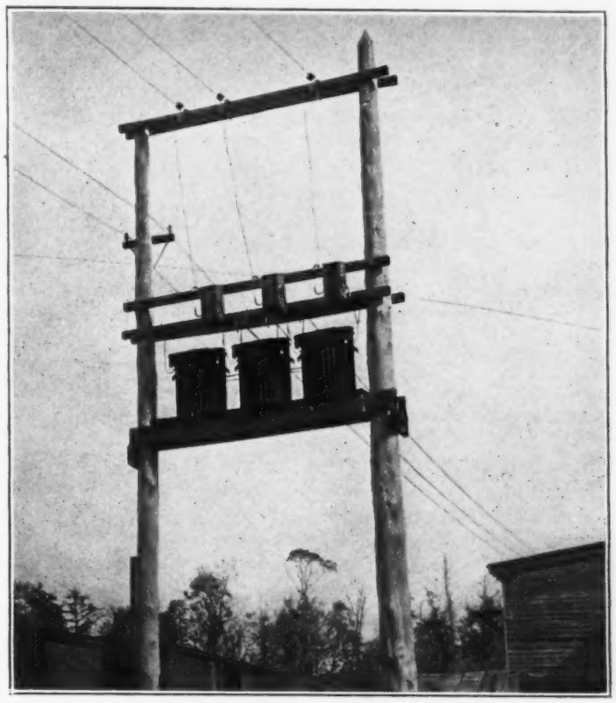


Fig. 7—Transformers for Adler May Company.

be installed. The triangular spacing of the wires for this voltage and short distance (6 miles) shows no advantages over placing all the wires on the same arm.

POWER-HOUSE EQUIPMENT.

When the Whistler line was built three 150-kw General Electric water-cooled transformers, stepping the voltage from 2300 volts to 11,000 volts, were installed. Multiplex lightning arresters in connection with choke coils protected the transformers. The bank is controlled on the 2300-volt side and is protected by an overload relay. When the Dauphin Lumber Company contract was received a duplicate equipment was installed. In addition a 15,000-volt hand-operated, non-automatic oil switch was installed in each bank. On the line side of these switches are disconnecting switches, and on the line side of the disconnecting switches is a 15,000-volt bus tie switch protected on each side by disconnecting switches. By this arrangement a bank can operate its respective line, a bank can operate the two lines, or the banks can be paralleled on the two lines.

SHOPS OF MOBILE & OHIO RAILROAD.

The shops of the Mobile & Ohio Railroad are located in Whistler about 6 miles north of Mobile. As these shops were in operation during the civil war, they are very old, and various machines were added from time to time until the steam equipment became inadequate and in order to carry on operation one department would have to stop work so as to have sufficient power to operate the machines in another department. Instead of installing a new steam plant an electric drive was established in the spring of 1908. The cost of the change from steam to electricity was very large, so it was decided to install a group drive.

There are thirty-eight motors in the shops, all of three-phase, 440-volt Westinghouse induction type, aggregating 588½ hp. The shops operate nine hours a day, but in a few cases have operated twenty-four hours a day. Based on a twenty-four hour day and twenty-six working days a month, the load factor is 16 per cent. The average number of kilowatt-hours used a month is 44,705.

The substation is located in the center of the longest of several buildings. This particular point used to be the entrance to a boiler-room, and as box cars have to come in this entrance the floor of the substation was built 14 ft. above the ground. In the station there are three 100-kw, 10,500-440-volt water-cooled transformers, each separated by a 4-in. reinforced-concrete barrier. The line enters the substation through sewer tiles built in the wall, and after passing through choke coils and series instrument transformers enters a 15,000-volt switch located in a concrete compartment. The buses then go direct to the transformers. The only instruments used are a kilowatt-hour meter and a voltmeter. The transformers are protected by General Electric multiplex lightning arresters.

MACHINE-SHOP EQUIPMENT.

One 25-hp, 675-r.p.m. motor belted to countershaft, driving:
- One 37-in. boring mill (Niles Tool Company).
- One 20-in. slotter (Niles Tool Company).
- One 24-in. double-head shaper (Niles Tool Company).
- One 18-in. lathe (Schumaker, Boyes & Emmes).
- One link-grinding machine (H. G. Hammett, Troy, N. Y.).
- One 18-in. shaper (Niles Tool Company).
- One 10-in. shaper (New York Steam Engine Company).
- One drill press (Niles Tool Company).

Average load, 16.4 hp; maximum load, 20.8 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
- One 36-in. lathe (Pond Machine Company).
- One 48-in. boring mill (Brausch Machine Tool Company).
- One 10-in. horizontal boring mill (Niles Tool Company).
- One 36-in. slow-speed emery wheel (Diamond Machine Company).
- One 24-in. brass turret lathe (American Tool and Machine Company).

Average load, 9.8 hp; maximum load, 13.1 hp.

One 5-hp, 850-r.p.m. motor belted to countershaft, driving:
- One 18-in. lathe (Niles Tool Company).
- One twist drill grinder (Willarth & Mermon Company).
- One No. 3 milling machine (Brainnard Milling Machine Company).
- One 12-in. shaper (William Sellers & Company, Philadelphia, Pa.).
- One 16-in. drill press (Fairbanks Company).
- One small emery wheel (built in shops).

Average load, 5.1 hp; maximum load 6.0 hp.

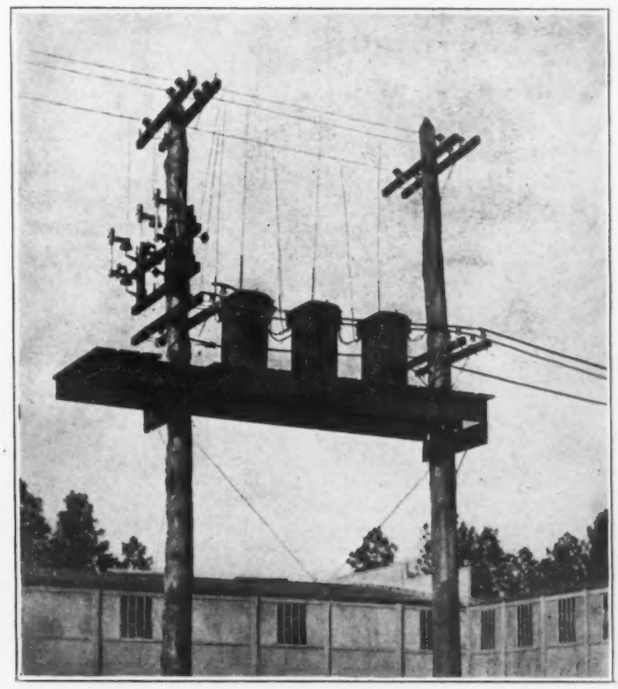


Fig. 8—Transformer Installation for Corinth Chair Factory.

One 25-hp, 675-r.p.m. motor belted to countershaft, driving:
- One 48-in. by 16-ft. planer (Niles Tool Company).

Average load, 20 hp; reversing load, 27.4 hp.

One 5-hp, 850-r.p.m. motor belted to countershaft, driving:
- One 16-in. brass turret lathe (Springfield Machine Company).
- One 14-in. brass lathe (Niles Tool Company).

One emery-wheel mandrel with two 24-in by 4-in. wheels; speed of mandrel 4000 r.p.m. (built in shops).
One 72-in. grindstone (built in shops).
Average load, 5.1 hp; maximum load, 6.1 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One 36-in. by 14-ft. planer (cutting speed 20 ft. per minute), (Niles Tool Company).
Average load, 9.40 hp; reversing load, 10.6 hp.

One 10-hp, 850 r.p.m. motor belted to countershaft, driving:
One 84-in. boring machine (Niles Tool Company).
Average load, 10.2 hp; maximum load, 12.9 hp.

One 5-hp, 850-r.p.m. motor geared to one 10-ft. radial drill press.
Average load, 2.6 hp; maximum load, 4.1 hp.

One 15-hp, 675-r.p.m. motor belted to countershaft, driving:
One 72-in. engine-wheel lathe (Niles Tool Company).
One 36-in. heavy-duty lathe (Niles Tool Company).
One 3-in by 20-in. turret lathe (Pratt & Whitney Company).
One centering machine (D. E. Whitten Machine Company).
Average load, 11.4 hp; maximum load, 14.8 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One 48-in. by 16-ft. planer (cutting speed 16 ft. per minute), (Putnam, Jr.).
Average load, 9.2 hp; reversing load, 10.9 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One vertical drill press (American Tool Company).
Three vertical drill presses (Niles Tool Company).
One 2¾-in. by 20-in. turret lathe (Pratt & Whitney).
One 18-in. lathe (Niles Tool Company).
One 3-in. pipe-threading machine (Niles Tool Company).

One 5-hp, 850-r.p.m. motor belted to countershaft, driving:
One 24-in. by 48-in. planer (cutting speed 25 ft. per minute), (no name plate.)
Average load, 2.3 hp; reversing load, 4.7 hp.

One 3-hp, 1700-r.p.m. motor belted direct to:
One 2¾-in. by 24-in. turret lathe (Jones & Lamson).
Average load, 1.21 hp; maximum load, 2.6 hp.

One 7½-hp, 850-r.p.m. motor, silent Morse chain drive, on:
One axle lathe (Niles Tool Company).
Average load, 6 hp; maximum load, 6.9 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One 13-in. bolt-heading machine (National Machine Tool Company).
One 13-in. bolt-heading machine (Acme Machine Company, Cleveland, Ohio).
One 13-in. threading machine (Acme Machine Company, Cleveland, Ohio).
One 13-in. threading machine (National Machine Tool Company).
One Bradley hammer (Bradley Manufacturing Company).
Average load, 7.4 hp; maximum load, 9.2 hp.

One 25-hp, 675-r.p.m. motor belted to countershaft, driving:
One 36-in. wheel lathe, two tools (Niles Tool Company).
One axle lathe, two tools (no name plate).
One car-wheel boring mill (Niles Tool Company).
One 36-in. emery wheel (Diamond Machine Company).
One 72-in. grindstone (built in shops).
One 13-in. ram (no name plate).
One 400-ton wheel press.
Average load, 18.2 hp; maximum load, 22.8 hp.

One 30-hp, 1120-r.p.m. motor belted to countershaft, driving:
One No. 7 Sturtevant blast fan (B. F. Sturtevant Company).
Average load, 35 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One 36-in. lathe (Pond Machine Company).
One 24-in. lathe (Niles Tool Company).
One centering machine (D. E. Whitten Company).
Average load, 7.2 hp; maximum load, 11.3 hp.

WOOD-SHOP EQUIPMENT.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One buffing wheel, speed 6800 r.p.m. (built in shops).
Starting load, 12.7 hp; average load after up to speed, 3.4 hp.

One 50-hp, 850-rp.m. motor direct-connected, driving:
One 30-in. car-sill surfacer (J. A. Fay & Company).
Average load, 48.3 hp; maximum load, 68.0 hp.

One 15-hp, 675-r.p.m. motor, using Morse silent chain, driving:
One 48-in. cut-off saw (Fay & Eagan).
Average load, 12.4 hp; maximum load, 14 hp.

One 25-hp, 1120-r.p.m. motor, using Morse silent chain, driving:
One 36-in. self-feed ripsaw (J. A. Fay & Eagan Company).
Average load, 26 hp; maximum load, 29.8 hp.

One 10-hp, 850-r.p.m. motor, using Morse silent chain, driving:
One 48-in. band saw (J. A. Fay & Eagan Company).
Average load, 10.5 hp; maximum load, 12.7 hp.

One 15-hp, 675-r.p.m. motor, belted to countershaft, driving:
One gaining machine (J. A. Fay & Eagan Company).
One mortising machine (J. A. Fay & Eagan Company).
Average load, 13.7 hp; maximum load, 17.6 hp.

One 75-hp, 850-r.p.m. motor belted to:
One double 70-in. shaving exhaust fan (B. F. Sturdevant Company).
Average load, 68.7 hp.

One 15-hp, 670-r.p.m. motor belted to countershaft, driving:
Two wood-boring machines (J. A. Fay & Eagan Company).
One 24-in. swing saw (J. A. Fay & Eagan Company).
One tenoning machine (J. A. Fay & Company).
Average load, 14.9 hp; maximum load, 22.6 hp.

One 25-hp, 675-r.p.m. motor belted to countershaft, driving:
One 16-in. ripsaw (J. A. Fay & Company).
One mortising machine (J. A. Fay & Company).
One tenoning machine (J. A. Fay & Company).
Average load, 17.4 hp; maximum load, 29.3 hp.

One 7.5-hp, 1120-r.p.m. motor belted to machine, driving:
One jointing machine (J. A. Fay & Eagan Company).
Average load, 7.8 hp; maximum load, 8.1 hp.

One 10-hp, 850-r.p.m. motor coupled to machine, driving:
One 12-in. molding machine (Fay & Eagan Company).
Average load, 11.7 hp; maximum load, 14.6 hp.

One 5-hp, 850-r.p.m. motor belted to countershaft, driving:
Tool-sharpening machines (Fay & Eagan Company).
Average load, 3 hp; maximum load, 3.95 hp.

One 15-hp, 675-r.p.m. motor belted to countershaft, driving:
One 16-in. ripsaw (Fay & Eagan Company).
One 20-in. cut-off saw (Fay & Eagan Company).
One 24-in. surfacer (Fay & Eagan Company).
One shaping machine (A. S. Gear & Company, Boston).
Average load, 13 hp; maximum load, 17.8 hp.

One 7½-hp, 850-r.p.m. motor belted to countershaft, driving:
One 30-in. band saw (Fay & Eagan Company).
Two wood-turning lathes (Fay & Eagan Company).
One 56-in. grindstone (built in shops).
Average load, 4.9 hp; maximum load, 7.6 hp.

FOUNDRY, BOILER AND BLACKSMITH-SHOP EQUIPMENT.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One cast-iron cleaning rattler (built in shops).
Average load, 8 hp.

One 30-hp, 1120-r.p.m. motor belted to countershaft, driving:
One No. 7 Sturtevant blast fan (foundry) (B. F. Sturtevant Company).
Average load, 19.1 hp.

One 10-hp, 850-r.p.m. motor, Morse silent chain drive, on:
One flue rattler (built in shops).
Average load, 9.8 hp.

One 3-hp, 850-r.p.m. motor belted to countershaft, driving:
Two flue cutters (built in shops).
One flue welder (built in shops).
Average load, 2.4 hp; maximum load, 3 hp.

One 10-hp, 850-r.p.m. motor belted to countershaft, driving:
One No. 10 punch and shears (Long & Allstatter).
One bolt cutter (built in shops).
Average load, 5.9 hp; maximum load, 8 hp.

PUMPING STATION.

One 20-hp, 690-r.p.m. motor-geared device, driving:
One triplex pump, 8-in. suction, 6-in. discharge, capacity about 300 gal. per minute, 100 lb. pressure (Platt Iron Works, Dayton, Ohio).

THE DAUPHIN LUMBER COMPANY.

The next large and notable installation is that of the Dauphin Lumber Company. This company always had its own plant, and each machine was either direct-connected or belted to a direct-current compound-wound 220-volt motor.

The work done by the Dauphin Lumber Company consists in dressing rough lumber for export. The company sometimes enters into a contract to ship a given number of thousands of feet of lumber within a specified time. On the night of May 10, 1911, the power plant burned, thus placing the mill out of commission. Something had to be done immediately, as the company was under heavy demurrage. A contract was signed with the Mobile Electric Company on May 12, 1911, to have the mill in operation by May 16, 1911. In order to do this all the direct-current motors had to be removed, and the mill had to be rewired, as three-phase alternating current was to be used instead of direct current. Some of the motors were connected by means of flexible coupling to the machines, while others were connected by rigid couplings, and in order to change these it was necessary to bore some of these couplings and

bush others so that they would fit the shafts of the new motors.

The nearest three-phase line was about half a mile distant. This extension was made and nine 20-kw transformers were installed, connected delta, using three transformers in multiple per phase. As the Dauphin Lumber Company is located nearly 6 miles west of Mobile and the voltage of this line is only 2300, it was feared that the mill would not be able to operate more than one-half of the machines. The total connected horse-power was 255. In order to raise the voltage nine 10-kw transformers which had their secondaries connected for 110 volts were connected in series with the nine 20-kw transformers in such a way as to give a three-phase current having a voltage of 330 at no-load.

It was found that when the 75-hp motor was started the voltage dropped from 330 to 120. With this emergency bank of transformers 210 hp could be operated, and the mill was in operation in the specified time.

It was decided as soon as the contract was signed to extend the 11,000-volt line from the power house directly to the mill. The substation erected is very different from that at Whistler, for the entire installation is exposed to the weather. The substation consists of a wood platform 8 ft. above the ground, 41 ft. long and 7½ ft. wide, supported on four 35-ft. poles and five posts. Between the first and second poles, which are spaced 18 ft. apart, three General Electric outdoor type multiplex lightning arresters are hung on 6-in. by 8-in. timbers. The second pole carries the choke coils and series instrument transformers. The third pole has the pole oil switch and shunt instrument transformers, and between the third and fourth poles the main transformers are located. These three transformers are rated at 75 kva. oil-cooled, and have taps on the high-tension side for 11,000, 10,800 and 10,600 volts. There are two sets of disconnecting switches, one to cut out the lightning arresters and the other to cut out all apparatus. The pole oil switch is so arranged that it can be operated from the ground by pulling a sash cord.

The secondaries of the transformers pass down through the floor and tap to two 500,000-circ. mil cables per phase. The substation is about 120 ft. from the mill and is located half way between the mill and a storage house, thus being as far as possible from all buildings in case of fire.

THE DRIVE.

One 75-hp, 900-r.p.m., direct-connected to No. 14 20-in. by 14-in. Berlin timber sizer, average load 68 hp.
One 75-hp, 1200-r.p.m., direct-connected to 15-in. No. 90 Berlin planer and mortiser.
One 50-hp, 900-r.p.m., belted to No. 55 900-h.p.m. Sturdevant exhaust fan.
One 50-hp, 1200-r.p.m., direct-connected to No. 77 15-in. American planer and mortiser.
One 15-hp, 1800-r.p.m., direct-connected to American 24-in. circular resaw, average load 12 hp, maximum load 22 hp.
One 10-hp, 1200-r.p.m., belted to Berlin No. 256 self-feed ripsaw, average load 8 hp.
One 5-hp, 1800-r.p.m., belted to American 36-in. knife grinder and emery stand.
One 5-hp, 1800-r.p.m.,belted to 24-in. trim saw.
Two 3-hp, 1800-r.p.m., belted to 18-in. trim saw.
One 3-hp, 1800-r.p.m., belted to combination window-frame machine.
One 2-hp, 1800-r.p.m., belted to rotary pump.
Total horse-power, 296; average kilowat-hours a month, 18,425; average load factor (ten-hour day and twenty-six days per month), 53.5 per cent.

SUMMARY.

WHISTLER LINE.	Horse-power.
Whistler shops	588.5
Chair factory	145
Stave mill	45
Planing mill	85
Abbattoir	67.5
Turpentine Cup Company (single-phase)	10
Total	882.0
DAUPHIN LUMBER COMPANY LINE.	
Dauphin Lumber Company	296
Total, both lines	1178

MANUFACTURING ICE WITH ENERGY FURNISHED BY THE CENTRAL STATION.

Modern Motor-Driven Plant of the Lincoln Ice Company, Chicago, Producing 1 Ton of Ice on 42 Kw-Hr.

EVERY day central-station electricity converts 120 tons of raw Lake Michigan water into pure artificial ice at the modern motor-driven plant of the Lincoln Ice Company, Chicago. For each ton of ice produced 40 kw-hr. to 60 kw-hr. is consumed by the motor-driven compressors and auxiliaries, and the title of "an ice factory without a chimney" is negatived only by the fact that a small amount of distilled water—10 or 15 per cent—must be added for freezing in the cores of the cakes. For this purpose about 1 ton of coal a day, or 1 lb. per 120 lb. of ice, is burned under an evaporator. The Lincoln plant is said to be the only large-scale installation in Chicago using the raw-water process, several other motor-driven factories having been converted to the distilled-water basis by the installation of complete evaporators with the opening of the present season.

The Lincoln company's modern electrically driven plant is located at the corner of Elizabeth Street and Carroll Avenue on the West Side, Chicago, the group of buildings including the ice-making equipment, freezing tanks, ice-storage rooms, offices, wagon-yard and stables. Practically

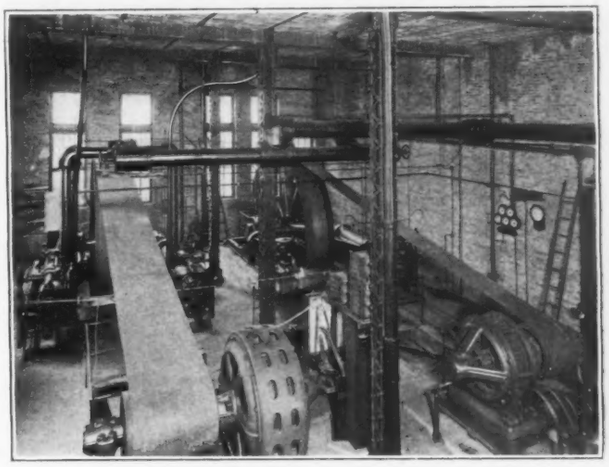


Fig. 1—Interior of Motor-Driven Ice Plant of Lincoln Ice Company, Chicago.

all of the motor-driven machinery is located in the compressor room, 40 by 100 ft., on the ground floor, thus grouping together under the best operating conditions all equipment requiring expert mechanical or electrical attention. The compressors are of the Ball Giant type, built by the Ice & Cold Machine Company, St. Louis. One has a capacity of 240 tons refrigeration, or 120 tons ice-making, per twenty-four hours, with its twin horizontal cylinders in operation. Only one cylinder of the second machine has been installed, making its ice production nominally 60 tons per day. The 120-ton machine is driven by a 300-hp, 220-volt, 60-cycle, three-phase General Electric slip-ring motor, running 496 r.p.m. at full load. A 30-in. belt connects the motor pulley with the 16-ft. compressor flywheel running at 70 r.p.m. Center distances of 35 ft. have been allowed between shafts. The single-cylinder compressor is similarly driven through a 20-in. belt by a 150-hp motor.

The power panel for the two large compressor motors is mounted in the center of the room between the machines and carries the individual Weston wattmeters and the instantaneous relays for the I-T-E circuit-breakers protecting each motor from overload. The starting controllers are

mounted in front of the power panels. Near by is the main service panel on which are mounted the totalizing Weston wattmeter and Thomson watt-hour-meter and the contact-making clock for the Minerallac printometer attachment, which gives a record of the consumption during suc-

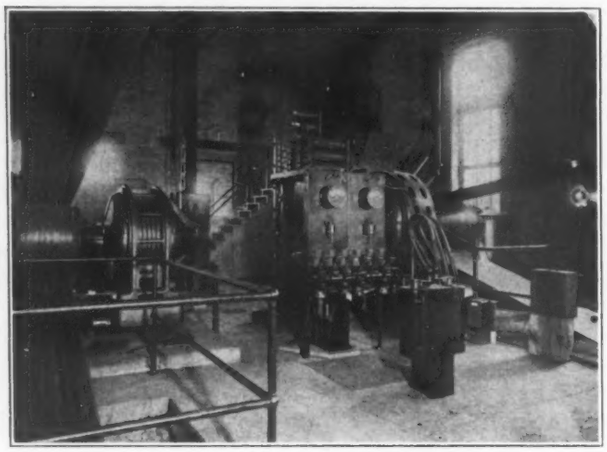


Fig. 2—Main Compressor Motors and Power Panels.

cessive intervals of time. The service meters and demand indicators of the Commonwealth Edison Company, which supplies the electrical energy to operate this plant, are installed at the rear of this panel. Pole-type transformers in the alley outside the building step down to 220 volts from the central-station company's distribution system. All wiring within the building is in conduit, including the lighting circuits as well as those supplying energy for the main and auxiliary motors.

The liquefied ammonia under pressure is allowed to expand directly in the expansion coils of the freezing tank, the brine which immerses both the expansion coils and cans being agitated by propellers driven by a 2-hp motor. Two freezing tanks are now installed, each containing 624 400-lb. cans 5 ft. deep, 22 in. long and 11 in. wide. Lake Michigan water from the city mains is used to fill these cans, after having been previously passed through a Federal quartz filter and the pre-cooling tank. To freeze this raw or undistilled water properly it must be kept agitated constantly by bubbling air up through the contents of each can. Air for this purpose is provided at 5-lb. pressure by two positive-type blowers, each driven by a 15-hp motor. Pipes convey this air supply to the side of each can opening, ending in special brass-socket fittings for receiving the tubular arms of the T-shaped ¼-in. pipes, the hollow shanks of which deliver the air to the bottom of the cans. The other arm of the T is solid and fits into a spring socket which presses it tightly against the air fitting. The compressed-air pipe can be quickly removed when the can is to be "pulled," being afterward restored to position by snapping it into place. The present improved T-pipes span the cans transversely, insuring accurate centering of the down-pipes so that they cannot become frozen into the growing ice mass.

Freezing, of course, begins around the outside of the cans, and when it has progressed to the point where only a 4-in. or 5-in. central unfrozen core remains this water, containing all the impurities that have been concentrated from the entire cake is withdrawn with the aid of Gould motor-driven vacuum pumps and its place filled with distilled water from the Swenson three-stage evaporator. The evaporator firebox is located on the compressor-room floor, and a lagged flue conveys the heat up to the evaporator tanks which are installed on the second story. Evaporators of this type are very economical in the use of fuel, the heat being withdrawn from the first quantity of water evaporated and used over again to vaporize the next, until in all three exchanges of heat are accomplished in this manner. The distilled-water make-up required for ice manufacture with Lake Michigan water amounts to 15 or 20 per cent of the total quantity of raw water used. In some instances it is understood that the distilled-water requirements have been as low as 10 per cent, but in the experience of the Lincoln company the larger quantity has been required. About 1 ton of coal is burned daily in the firebox of the evaporator, representing a consumption of 1 lb. of fuel for each 120 lb. of ice manufactured. The distilled water from the evaporator is delivered into a tank, from which a float-controlled ¾-hp motor elevates it to the fore-cooling tanks from which the core spaces are filled.

A 400-lb. cake of ice can be frozen in twenty-four hours if necessary, but the average cycle in the Lincoln installation is forty-eight to fifty-two hours. After the cakes and cores have been frozen solid, the cans are "pulled" with the aid of compressed-air hoists mounted on overhead hand cranes spanning the tank room. Compressed air for operating these hoists is supplied by a motor-driven pump delivering 60 lb. pressure per square inch. With the aid of the cranes the cans are raised and pushed by hand to the "dumps," where hot water is played over the surface of the tanks, melting the cakes free and discharging them into weighted elevators, which lower the ice without breaking to the storage room beneath, or for loading directly on to the wagons.

The heat which is removed from the ice during process of freezing is discharged from the expanded ammonia into the atmosphere through the medium of an atmospheric condenser and cooling tower located at the top of the building. Twenty stands, each comprising thirty-four 2-in. pipes, 22 ft. long, comprise the condensers. Above the condenser is the cooling tower, where the circulating water has its temperature lowered by evaporation. Two 15-hp motors driving centrifugal pumps, each capable of delivering 400 gal. per minute, serve to circulate the cooling water, a single unit being sufficient during ordinary operation. Close watch is given to both the wet and dry bulbs of the hygrometer, and in case the humidity of the atmosphere reaches a point beyond which it is not economical to operate the cooling tower city water is used directly for cooling, being discharged into the sewer. The presence of a large body of water like Lake Michigan near the plant serves to saturate the air when the wind is from the east, and thus decreases the evaporative action of the cooling tower.

Under winter operating conditions with low-temperature

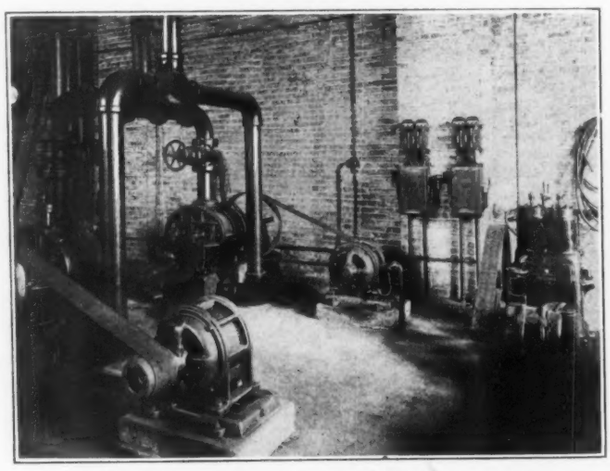


Fig. 3—Motor-Driven Blowers for Air Agitation and Compressor for Pneumatic Hoist.

cooling water, a ton of ice has been made in the Lincoln plant at the expenditure of but 42 kw-hr. to 43 kw-hr., including the operation of all auxiliaries, besides the plant lighting, which is under the same meters. Under summer operating conditions, with warmer cooling water, a ton of

ice is ordinarily produced at the expenditure of from 58 kw-hr. to 60 kw-hr. Under the terms of the customer's contract with the Commonwealth Edison Company a load factor of 60 per cent on the twenty-four-hour basis, 365 days a year, is assured. Service is supplied under the central-station's off-peak contract, by which it is provided that energy shall not be used between the hours of 4 p. m. and 8 p. m. during November, December, January and February.

ELECTRICITY ON CATSKILL AQUEDUCT FOR NEW YORK CITY WATER SUPPLY.

New York Edison, United Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn Supply Central-Station Energy to Contractors.

The New York City section of the Catskill Aqueduct has been, for the purpose of more rapid construction, divided into four contracts, known as contracts No. 63, No. 65, No. 66 and No. 67. These extend from the city line between New York City and Yonkers, south to the borough of the Bronx, under the Harlem River, under Manhattan Island, to a point at about Clinton and South Streets, where they cross under the East River into Brooklyn. To accomplish this work twenty-four shafts are being sunk.

Contract No. 63 is being carried out by Messrs. Mason & Hanager, of Richmond, Ky. This concern is using a large amount of electric energy furnished by the New York Edison Company, a contract having been negotiated with it for 1500 hp.

Contract No. 65 was awarded to the Pittsburgh Contracting Company, Pittsburgh, Pa. This contractor is using electricity throughout for all lighting and power purposes, having contracted with the New York Edison Company for the supply at shafts No. 6 and No. 7. The company has also contracted with the United Electric Light & Power Company for the five other shafts that come under this contract. The installation at shaft No. 6 is typical of each of the other shafts, the installation being as follows: One 150-hp hoist; one 40-hp derrick; six electric drills of 3 hp each; two pumps, one of 15 hp and the other of 5 hp; one 30-hp ventilating fan; two 15-hp excavator hoists; one 20-hp motor-generator set; one 20-hp concrete mixer; one 10-hp grout mixer; two 5-hp concrete hoists; one 75-hp rock crusher, and a miscellaneous supply of about 25 hp for machine tools, etc. With the exception of the large hoist all apparatus will be operated by 220-volt, 60-cycle motors. The voltage of the supply to the large hoisting engine will be 2200. One of the most interesting features of this contract is that the contractor is using electric drills for all excavation, no air compressors having been installed on the job. This is perhaps one of the first instances in this section of the country where electric drills alone have been adopted to carry on any large construction work.

Fig. 1—Electric Hoist in Central Park.

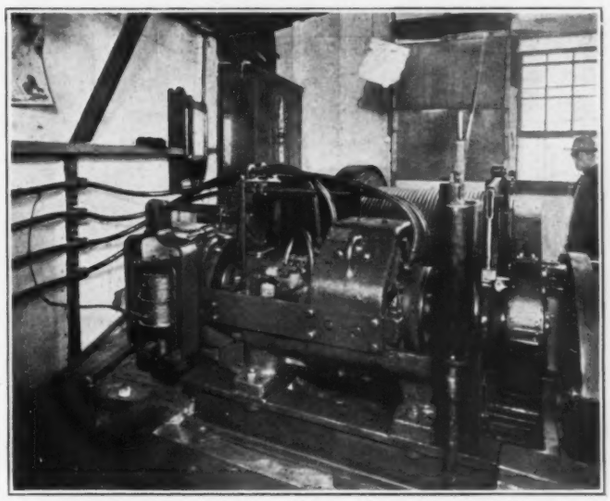


Fig. 2—Electric Hoist at Bryant Park.

The contract next to the south is No. 66, in charge of Messrs. Smith, Hauser, Locher & Company. These contractors are also using electric energy exclusively to meet all of their requirements, having contracted with the New York Edison Company for a supply of not less than 3000 kw, energy being supplied at three-phase, 25 cycles, 6600 volts. As three of the shafts on this contract are located in Central Park, it was thought advisable to install a central compressor plant, so at shaft No. 14, the center of the three, there are installed three Sullivan air compressors

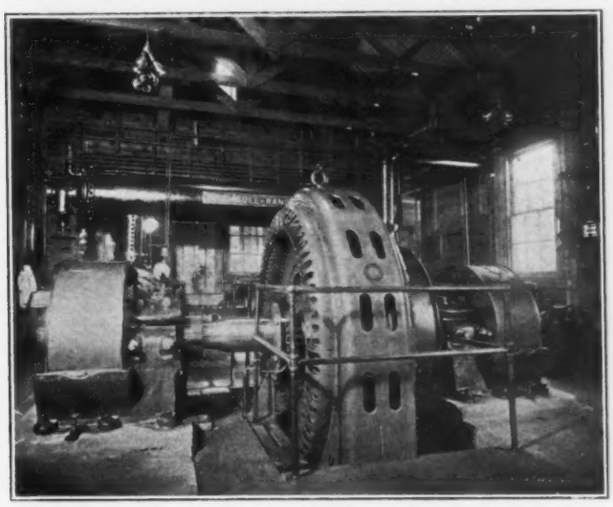


Fig. 3—Compressor at Shaft in Bryant Park.

with a capacity of about 2000 cu. ft. of free air per minute per unit, compressing to a pressure of 100 lb. These compressors are directly connected to Westinghouse synchronous motors. These motors are operated at 6600 volts. At shafts No. 16, No. 17 and No. 18 one compressor each is installed, these being of the Ingersoll-Rand type operated by Crocker-Wheeler synchronous motors of 360 hp each. These motors are also operated at high tension. In addition to the compressing plant, the following equipment is located at each shaft: One 35-hp pump; one 3-hp pump; one 20-hp blower; two General Electric storage-battery mine locomotives, and, one 90-hp hoist.

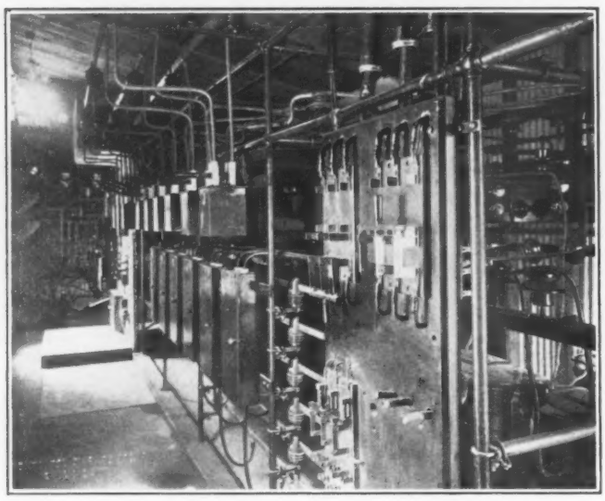


Fig. 4—Transformer Room in Central Park Shaft.

It is the countractors' intention to make a very thorough trial of storage-battery locomotives for this class of contracting work, so that the difficulty of overhead trolley in a tunnel of small section may be eliminated. These locomotives are equiped with General Vehicle batteries of forty-four cells each, having a capacity of about 270 amp.-hours, with a normal rate of discharge of 45 amp. Charging posts will be installed at the bottom of each shaft, so that the batteries may be recharged without bringing them to the surface.

Messrs. Holbrook, Cabot & Rollins are the contractors on contract No. 67. On this contract there are three shafts in the borough of Manhattan and three in Brooklyn, contracts having been signed with both the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn for the respective supplies. As in the case of the other contracts, electrical apparatus is used for all the plant, the installation at each shaft being about as follows: Two air compressors, one operated by a 164-hp and the other by a 215-hp synchronous motor, current being suplied at 6600 volts, three-phase, 25 cycles. The other machinery will be one 75-hp hoist, two 25-hp derricks, two 15-hp concrete mixers, one 20-hp ventilating fan and two 20-hp pumps. The derricks, concrete mixers and pumps will be operated by direct current, the remainder with alternating current at 230 volts and 440 volts. One of the novel features of this contract is the extreme depth of some of the shafts, shaft No. 21 at Clinton and South Streets, borough of Manhattan, being about 710 ft. below the level of the street. It is probable that the electrical apparatus will be increased, for as some 15-deg. grades are encountered in certain parts of the tunnel, electric hauling engines will have to be installed. In addition to this, where the grade is not excessive, it is probable that storage-battery locomotives will be used. On contracts No. 63 and No. 66 the shafts have been completed and the headings turned. On contract No. 65 the shafts have very nearly reached their maximum depth, while on contract No. 67, as it has been necessary to sink down to rock with caissons, this work has of necessity progressed much more slowly. Rock has been reached, however, on each of these last named shafts and the air taken off.

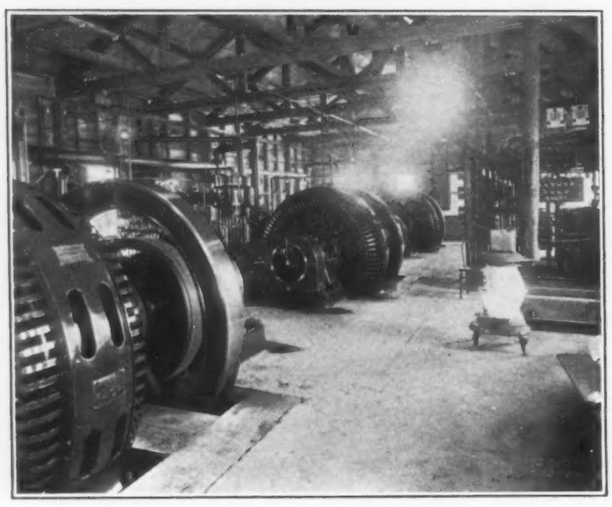


Fig. 5—Compressor Room, Central Park Shaft.

MOTOR SERVICE IMPROVEMENTS IN BOX-MAKING PLANT.

Recent applications of the individual motor drive display a decided tendency on the part of designers to employ mountings capable of bringing the electrical equipment well within the projected area of the machine, and to utilize chain, belt or gearing connections planned to reduce the friction of the driving mechanism to the minimum. The following photographs taken in the box-making plant of the New England Box Company, of Ashuelot, N. H., illustrate these points. About thirty motors, all of the three-phase, 220-volt induction type, are in service, the individual drive being standardized throughout the factory. The motors were supplied by the American Rotary Valve Company and are of the "Jenney" design. Fig. 2 illustrates a row of 45-in. circular resaws and a similar smaller saw direct-driven by 7½-hp to 10-hp motors with vertical shafts. In this plant the electric drive was selected chiefly on the score of its great economy in maintenance and its service reliability. The fuel burned by the

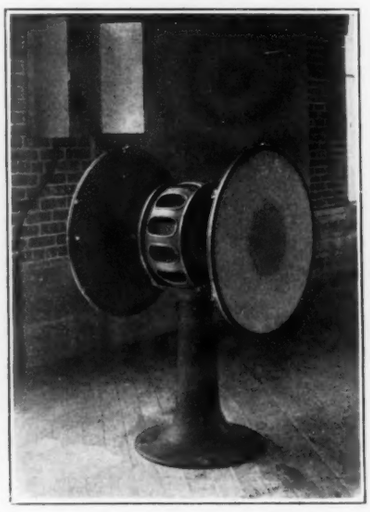


Fig. 1—Motor-Driven Sand-Papering Wheels.

company costs little, being substantially a by-product, but with the ordinary mechanical drive the cost of maintenance and interruptions was found to be prohibitive. In the installation of resaws each motor is mounted inside the machine housing and supported by brackets attached to the frame, extension bearings taking the centering heads being

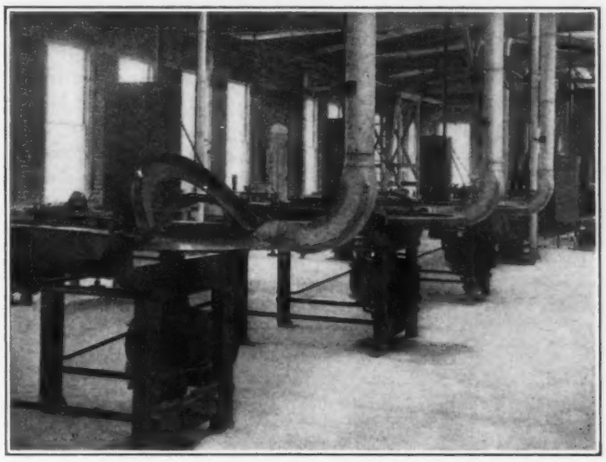


Fig. 2—Motor-Driven Circular Resaws.

provided at the top and bottom, so that the bearings are bolted to the machine frame, saving space and insuring solidity of support. Each motor is equipped with a step-socket bearing at the lower end and a guide bearing at the upper end of the shaft. The resaws are run at 1140 r.p.m., the motor speed, and the sawdust is exhausted from the machines through pipes leading to a trunk-line collector feeding the boilers. The illustration also shows a saw guard turned out of normal position.

Fig. 3 illustrates a box-nailing machine driven through a combination of gearing and belting by a 2-hp motor. The arrangement of driving was made in the interests of

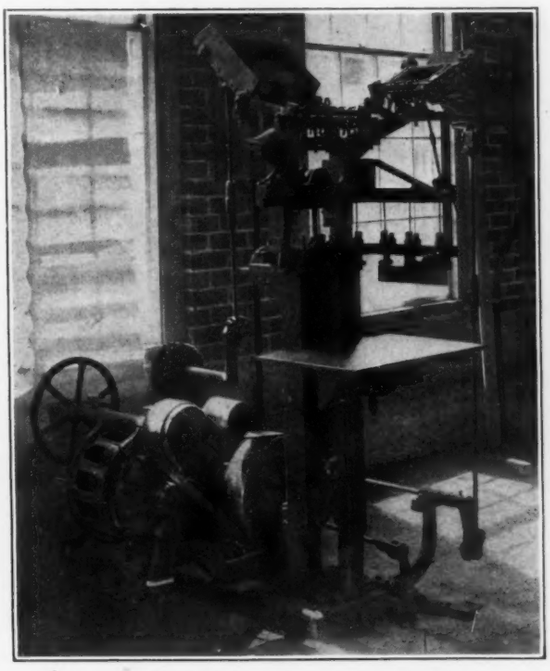


Fig. 3—Motor-Driven Box-Nailing Machine.

moderate first cost, the motor being a comparatively high-speed machine, running at 1700 r.p.m., while the nailer is a slow-running equipment. The reduction is secured by a pinion and back-gear installation, the gear being mounted on a horizontal shaft carrying a pulley at its end from which the main machine shaft is driven. An idler is provided on the slack side of the belt to facilitate adjustment of the drive. Fig. 4 shows at the left a matching machine and in the center a trimming machine, three motors being required in their operation. A 15-hp motor drives the spindles and saws at both ends of the former, and a 10-hp

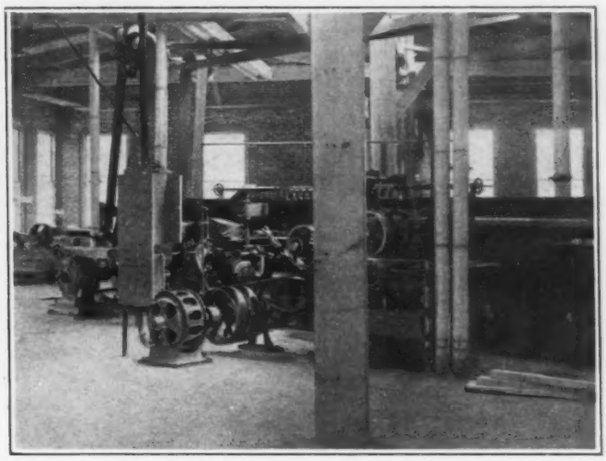


Fig. 4—Motor-Driven Matching and Trimming Machine

motor, not shown in the photograph, drives spindles and feed at the opposite end. The trimming machine is driven by a 10-hp motor equipped with a shaft coupled to an extension pulley shaft from which the machine is driven by suitable belts. The use of the extension shaft eliminates the need of a countershaft on the trimming machine and reduces the friction of the drive as well as simplifying the construction. Fuses and a compensator switch for starting are mounted in a box above the floor level and near the driven machinery.

The flexibility of the motor drive is illustrated in Fig. 5, which shows a swing saw designed for overhead sus-

Fig. 5—Motor-Driven Swing Saw.

pension, a 5-hp motor being provided. A duplicate motor-driven equipment is shown at the rear, the saws being 15 in. in diameter in each case. The saw bearings are carried at the bottom of a frame hung from horizontal bearings attached to a head-frame suspended from the

motor, the latter being bolted to the ceiling. The arrangement eliminates the use of tight and loose pulleys and countershafts and is compact and convenient in its operation. Fig. 5 illustrates a corner-smoothing machine consisting of two sandpapering wheels and a 5-hp motor mounted on a common pedestal and shaft, the leading-in wires being carried to the motor inside the pedestal. The arrangement reduces the number of bearings required to the minimum and avoids the use of all countershafting and belting. It represents practically the extreme of simplicity, the motor being of the squirrel-cage type and operating at constant speed. All the motors shown are of the constant-speed type, with squirrel-cage rotors, and in their attachment to the various tools illustrate the benefits of the direct drive as the most flexible and economical source of motive power.

ELECTRICITY DEVELOPING THE COLORADO MINING FIELD.

Electric power is rapidly coming to the front as one of the vital necessities of industry in Colorado. A recent investigation of the more important plants in operation showed that the principal central-station and wholesale-distributing companies now have available a generating capacity of almost 100,000 kw. Forty per cent of this service is furnished by hydroelectric stations and the balance by steam plants. It is estimated that an additional generating capacity of about 97,000 kw is now in the service of private owners, and close observers of the tendencies of electrical development in the State predict that in a year or two a larger portion of the energy will be produced in hydroelectric stations than in steam plants.

About twenty hydroelectric systems of considerable size are now in service, ranging in generating capacity from 20,000 kw downward, some of the principal companies being as follows: Central Colorado Power Company, 20,000 kw; Telluride Power Company, 4800 kw; San Juan Power & Light Company, 4500 kw; Pike's Peak Hydroelectric Company (part of Colorado Springs system), 2250 kw; Pueblo Suburban Traction & Lighting Company, Victor, 1600 kw; Revenue Tunnel & Mining Company, Ouray, 1100 kw; Salida and Dillon companies, 2000 kw. The principal steam-driven plants include the Denver Gas & Electric Company, 14,750 kw; Denver City Tramway Company, 9500 kw; Northern Colorado Power Company, 6000 kw; Colorado Springs system, 5250 kw; Pueblo local system, 4110 kw; Canon City system, 4600 kw, and Trinidad system, 4600 kw. In addition to the foregoing installations are several large plants owned and operated by the American Smelting & Refining Company, Colorado Fuel & Iron Company, Victor American Fuel Company, Colorado and United States Portland Cement companies, Colorado Yule Marble Company, and many smaller organizations.

With few exceptions the service of most of the above organizations is in considerable part utilized by the mining or closely related industries. Outside the cities and agricultural districts of northern Colorado nearly every large power company sells a substantial output to mines or reduction works and the benefits of electricity in giving new life to the mining industry are being recognized in official circles. The biennial report of the Colorado Commissioner of Mines for the years 1909-10 bears eloquent testimony to the economic advantages of electric power service. Commissioner T. J. Dalzell, touching upon the recent development of large power systems in the State, says: "Of rates charged by these companies for the operation of mine hoists and equipment, mills, reduction works and dredges, nothing can be said but praise. The charges are adjusted to figures which range around from one-half to three-fifths the former costs for coal. Besides this, service is afforded at places that were heretofore out of the reach of coal and the business of mining and lessened costs in mining have been materially advanced." Touching upon the work of the Colorado Electric Power Company, of Canon City, Mr. Dalzell says:

"It was established primarily to furnish power for the Cripple Creek Mining District and proved immediately to be a great boon to mining operations in that district. Previously the mines were subject to a charge of $5 per ton for coal to generate steam power, and the coming of electrical power not only materially reduced this feature of mining costs, but gave the camp an unfailing power supply. It further aided the smaller operators and lessees who would not otherwise have been able to conduct mining operations. Later its power has been used by the cities adjacent and by the Colorado Fuel & Iron Company in its coal mines throughout Fremont County. This great business and aid to mining has sure fields of development in the southerly and southwesterly mining sections of the State. The Trout Lake plant and the Telluride Power Company have already done a great deal, but still cheapened power for mine and mill operation is certain to come to the San Juan country from further harnessing of the mountain streams everywhere falling out of the high sections. The high mountains are here; reservoir sites abound; the great rivers that constitute tributaries to some of our country's largest and most majestic streams have their origins in the Continental Divide, and it is certain that hydroelectric power is sure to play a very large part in the mining industry of this, the foremost mining state of the Union."

Further testimony of the value of electric power comes from the Boulder County Metal Mining Association, which says in part: "The company's rates (referring to the Central Colorado Power Company) are adjusted to be fair to all consumers and to encourage its consumers to so arrange the operations of their machinery as to give the company a load wherein the maximum power requirement approximates as nearly as possible the average power demand, thus permitting the company to sell its current at the lowest possible unit cost. In the mining industry the machinery for getting out the ore, extracting and reducing it to a marketable product must necessarily be located at the mine, as the ore bodies cannot be moved to the source of power supply. One of Boulder County's problems in the past has been to get fuel to its mines, the transportation of fuel over mountain roads always being a serious matter. It is a comparatively simple matter to run an electric circuit anywhere."

Another discussion of the power development of the State calls attention to the fact that electricity is taking the place of steam in the big mines of Colorado and that without it many mines that are now working at a profit in Lake, Teller, Boulder, Gilpin and Summit counties would be idle. All over the State the new power has come to mean new life to the miner. All over the mining regions electricity is employed to drill the powder holes, hoist the ore to the surface, haul the product to the point of shipment, pump the properties dry, ventilate both coal and metal mines and perform miscellaneous service in the industry, from the gold, silver or zinc-bearing seam to the mill. Without regret the miner sees the wheezy boilers, loose-jointed, leaky steam pipe and balky fire boxes go their way into the junk pile and become superseded by the electric motor. Colorado is full of coal that can be bought at a reasonable price in most parts of the State, but for many years there was no crying demand for cheaper power because mining was not reduced to the exact science it is to-day and economy occupied a small place in the minds of operators. The high-grade ore was taken out and treated at a large profit without regard to the cost of production. The subsidence of high-grade ore has necessitated the adoption of the most efficient methods, and here electric power is stepping in to save the day in co-operation with cyanide

and chlorination mills capable of extracting a profit even from tailings. Since the advent of electric-power service the miner has suddenly discovered that where he had been paying from $5 to $12 per ton for coal he could get the same amount of electric energy at a reduced cost of 25 per cent to 80 per cent.

Both direct and alternating-current services are utilized in the mines of the State, but the latter predominates. In many cases, if the distance of transmission exceeds 2000 ft., three-phase service is employed. Direct-current service is more common in the coal mines. Of twenty-three important mines recently examined twenty-two purchase energy at voltages varying from 500 to 24,000. Power is purchased in practically all the large mining districts. The use of flywheels is receiving consideration in connection with the reduction of fluctuations. The average power-factor of about twenty-five installations covered was 80 per cent, induction motors being the most common equipment for machine driving. The load factors of the machinery frequently run as high as 90 per cent. The nine plants provide a desirable load for the power company on account of the relatively large amount of power required for each unit. Hoists require from 3 hp to 400 hp each as a rule, and a singe large mine may require up to 400 hp in pumps, 500 hp in air-compressor equipment and up to 100 hp batteries in haulage locomotives. In one or two instances storage batteries are used in connection with direct-current hoists to reduce the fluctuations. In general the size of motors on mining locomotives varies from 5 hp to 15 hp each, many locomotive units being rated at from 20 hp to 30 hp. A majority of mine superintendents interviewed concurred in the opinion that it is safe to carry 2300-volt service down a wet shaft if the best types of lead-covered, rubber-insulated cable are employed.

VARIABLE-SPEED INDUCTION MOTORS IN PRINTING PLANT.

A variable-speed, three-phase, induction, motor-driven printing installation has lately been placed in service on the system of the Boston Edison company at the plant of the Norwood Press, at Norwood, Mass. Over one hundred 220-volt Jenney motors are now in service, all being individually connected to the machines by short belt drives or gearing. The speed control is effected by the use of resistance grids in circuit with the rotors, a special feature being the arrangement of the controllers to cut in and out resistance evenly on each phase, thus preserving the efficiency of the motor at a higher level than in cases where the rotor resistance is run unbalanced. Cutler-Hammer cylindrical type controllers are installed, and all wiring in connection with the individual drives is in iron conduit. The rheostats are protected by wire screens against paper scraps and other loose material, and are in most cases mounted on the inside of the machine frames near the floor. The motor drives in the plant illustrate a variety of mechanical applications, the location of the motor in each case being such as to permit sweeping under the machine and the passage of employees through the inter-machine aisles. Under the former conditions of driving in the plant the aisles were so badly obstructed that it was frequently impossible to pass between machines, and the maintenance of good floor conditions was out of the question.

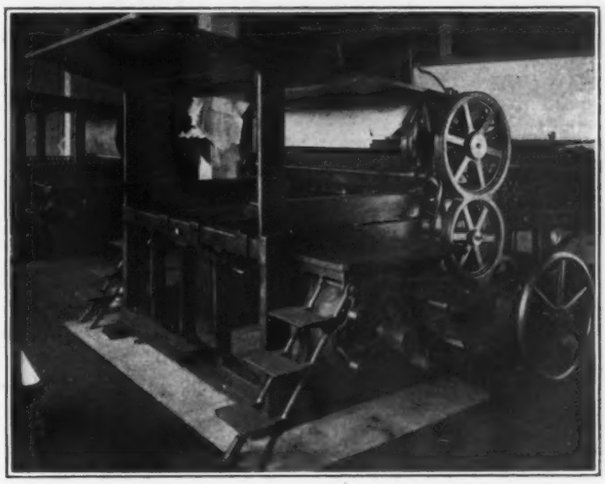


Fig. 2—Press Driven by 5-hp Variable-Speed Induction Motor.

Three typical drives are illustrated herewith, an idler being provided in each instance on the slack side of the belt. The motors are rated at 4 hp, 5 hp and 7½ hp, and are respectively mounted on the inside of the press frame, beneath the operating platform, and at the end of the frame. In the case of the inside drive the motor is almost entirely out of the way, while with the end suspension of the motor from a bracket first-class floor conditions are combined with the maximum accessibility. Six speed changes are usually installed, the range in the cases of the 4-hp and 5-hp motors being from 1100 r.p.m. to 500 r.p.m.

In the Norwood plant the cost of energy is about one-third the total which the company sustained before the individual motor drive was installed.

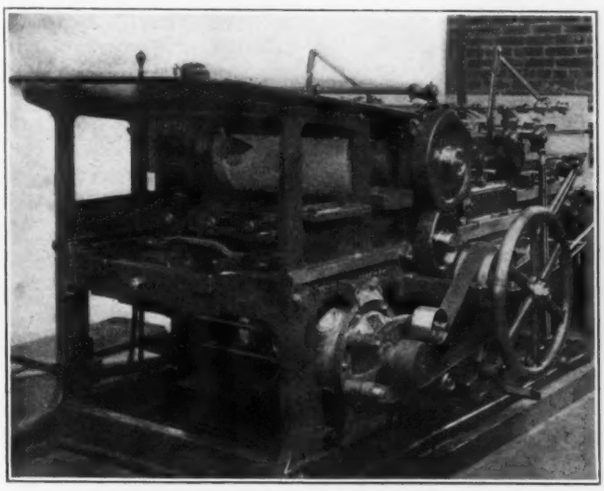


Fig. 1—Press Driven by 4-hp Variable-Speed Induction Motor.

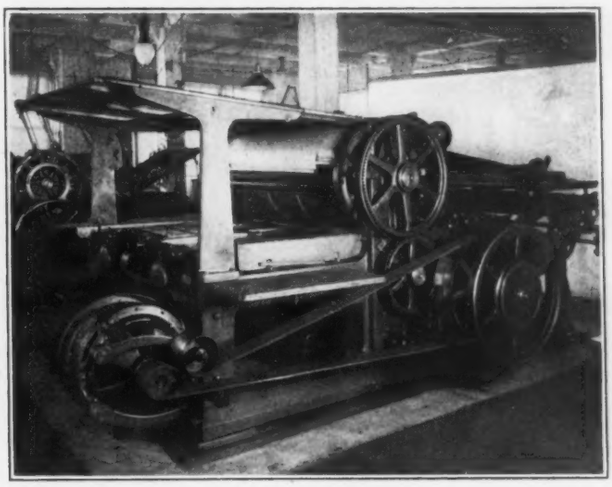


Fig. 3—Press Driven by 7½-hp Variable-Speed Jenney Induction Motor.

MOTOR-DRIVEN BAGGAGE-TRUCK SERVICE AT BOSTON TERMINAL.

One of the latest and most efficient applications of the motor drive is in the operation of baggage trucks at railway terminal and way stations where the volume of traffic is so large that the employees are constantly hard pressed to handle the work. Electricity is entering this field with great success, and remarkable economies in time and labor have resulted from the pioneer installations which have been made within the past few months. A representative equipment in use at the South Station, Boston, is illustrated herewith, the apparatus consisting of a steel framed chassis carrying a battery box, controller switches, motor and running gear, with platform for the carriage of trunks, sample cases, mailbags, newspapers and other merchandise The Boston truck, which was built by the Automatic Transportation Company, of Buffalo, N. Y., is mounted upon four 16-in. solid rubber-tired wheels having a wheelbase of 52 in. and a tire width of from 2½ in. to 3½ in., the former being used on the pilot wheels, or the pair by which the truck is steered, and the latter on the other pair, which is connected with the motor drive.

The truck is equipped with twenty-four "GWBH" National cells of 112 amp-hr. capacity and a 50-volt motor normally rated at 2½ hp but capable of delivering 7½ hp during acceleration. Chain drive is employed, each of the driving wheels being connected to an independent pinion geared to the motor shaft. The truck is equipped with a combination pedal and band brake with auxiliary contact switch, by means of which it cannot be started unless the operator's foot is on the appropriate lever, and in case the operator's foot is removed the contact is instantly broken and the brake applied by a spring, so that the truck comes to a standstill within the shortest possible distance and time. This is a vital factor in terminal operation, where trunks and mail must be handled rapidly over platforms frequently crowded by passengers. The truck used in the Boston service has an over-all length of 10 ft. 3 in., with end gate up, and a loading space of 3 ft. 6 in. x 7 ft. 1 in. The platform is carried 20 in. above the floor, ordinary hand trucks having platforms raised from 28 in. to 36 in. above the floor. The operator can drop the end gate of the truck in three seconds, thereby increasing the length of the loading space to 10 ft. 2 in. A steering lever is provided at each end of the truck, and also a controller lever, giving five speeds forward and five in the reverse direction. The controller is of the drum type, and is carried inside the chassis frame near the battery box. The maximum speed is 10 miles per hour empty and 8 miles per hour loaded, the weight of the truck alone being about 2000 lb. and its capacity about 4000 lb.

Fig. 1—Old-Style Baggage Truck.

The operating efficiency of the truck is indicated by the speed with which it handles the work in comparison with the older hand service. It easily does the work of three four-wheeled, man-handled baggage trucks. With the latter two men are usually required per truck, while with the electric truck one man only is required in the majority of cases, the second man or porter remaining on the train platform and assisting in loading and unloading without pushing the truck. The truck can be turned completely around within practically its own length. The battery is charged during the night from the station generating plant, and the truck averages about 25 miles per day. With a skilled operator it can be used in loading belated mail-sacks into a train after the latter has begun to move, keeping up the work until a speed of 5 or 6 miles per hour has been reached, while with the hand-operated truck it is impracticable to load sacks for more than two car-lengths after the train starts. Another important point is the reduction in fatigue, which leaves the operator much fresher for work at the end of the run than with the old hand-pushing methods. One man has frequently done in nine minutes what would take two men eighteen minutes with the hand truck. In a recent performance the truck left the inward baggage-room at the South Station at 9.57 a. m. with a load of trunks for the Bay State Limited, which was due to leave at 10 a. m. on a track about a quarter of a mile distant. The truck reached the baggage-car of the train at 9.58½, and made another delivery on a distant track, reaching the baggage-room again after a total absence of 6 minutes. In regular loading of the Sunday edition of a Boston daily two men handled a load with the electric truck in one hour that formerly required the services of five men and two hand trucks for two hours.

Fig. 2—Motor-Operated Baggage Truck.

Fig. 3—Motor-Operated Baggage Truck.

Thirty-five pieces of baggage have been handled on a single trip, and on other single trips 110 sacks of mail have been carried. The result of the truck's service has been a noticeable reduction in the congestion of the baggage-room, and it is probable that this method of handling the work will be much extended.

HANDLING MATERIAL ECONOMICALLY IN A MARBLE PLANT.

In the production of heavy material for industrial service the importance of economical handling is often a controlling factor in the success of the enterprise. This is particularly true in large plants engaged in the fabrication of stone. Skilled labor is an important feature in the work

Fig. 1—Electrically Operated Derricks.

of the marble or granite mill, and the need of losing the minimum time in setting up work is insistent. The three accompanying photographs illustrate the efficiency with which stone is handled from the quarry through the mill to the railroad at the plant of the Colorado Yale Marble Company, of Marble, Col. Electricity is used throughout the plant for transportation, hoisting and general tool service, including the driving of air compressors.

Fig. 1 shows the method of handling the marble by derricks and cableways at the quarry. The steel derrick shown

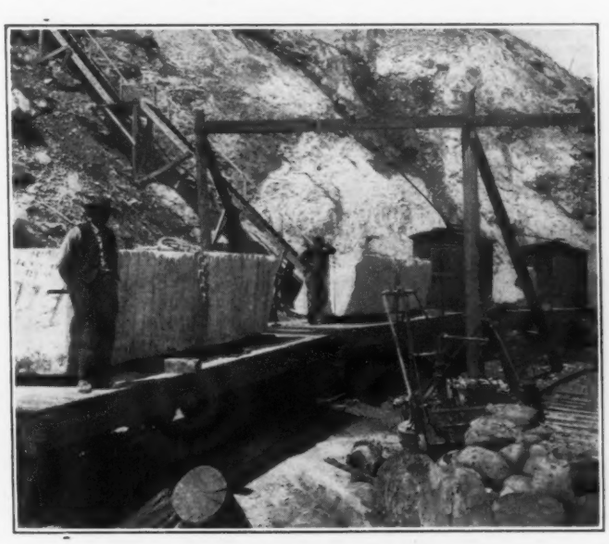


Fig. 2—Electric Locomotives.

has a lifting capacity of 50 tons and is driven by a 125-hp induction motor. It has a 90-ft. boom and is located near the cableway leading to the valley 2000 ft. below, where an electric railway owned by the company connects with the mill. The cableway has a haulage capacity of 25 tons and is driven by a 125-hp motor. Fig. 2 shows the continuation of the process of economical handling by the electric railway. Use is made of two electric locomotives capable of hauling 22 tons up a 13 per cent grade. Gravity is utilized to a large extent in shipping the marble to the mill, the return trip being frequently turned to account in the shipment of tools and supplies to the quarry.

Fig. 3 shows the crane facilities in the yard at Marble, the principal features being a runway 1580 ft. long parallel to the receiving and shipping tracks, a 12.5-ton crane and a 25-ton crane on the same runway to facilitate work at both ends of the yard simultaneously and the opportunity to transfer material and products either through or past the mill to the private steam railroad of the company, which connects with the main lines of the State at Carbondale. A block of marble can be taken from the quarry

Fig. 3—Electrically Operated Traveling Crane.

and placed in the shop 4 miles distant in 45 minutes, compared with several days in foreign plants less favorably equipped.

LUMBERING WITH ELECTRIC MOTORS IN THE NORTHWEST.

A novel application of the electric motor which promises to create a new industrial load in the great lumber country of Washington and Oregon, as well as to revolutionize felling and transportation costs in that section, is the use of motor-driven winding engines for "snaking" the big logs from the places where they are cut out to the water's edge for floating down to the mills. One of these electric logging machines is already in use in the Coos Bay country and has demonstrated the economies which it can effect over the isolated steam engines now in use. Experiments are also being made in the lumber fields with motor-driven tree-felling machines, using rapidly moving wires which by friction burn kerfs through the tree trunks.

The method of transporting the logs out from the field with the present steam-power units is as follows: Through the center of the "field" in which the felling is to be done a "road" is cleared and smoothed to serve as a central traffic artery for moving the logs to the water's edge of the mill. Along this road are located the various logging engines used for "snaking" the logs out from the field and on to the road. Each outpost engine pulls from within a radius of half a mile, delivering its logs into the road, where the "road" engine at the water's edge may pull them from a distance of 1½ miles. As many as fifteen such logging machines may be at work in a single field where trees are being felled. The forest growth in the part of the State where power logging is now carried on comprises principally fir and red cedar. Some of the logs handled contain as much as 6500 ft. of lumber board measure, and are dragged along the ground at speeds as high as 15 miles per hour.

The electric logging machine illustrated makes use of

a 165-hp, 440-volt mill type motor, the maximum demands on which reach 175 kw in service. The motor is arranged to drive through gears either of two reels. The larger reel carries the 1¼-in. main steel cable used for hauling the logs. The smaller reel is provided for the ¾-in. steel "pay-

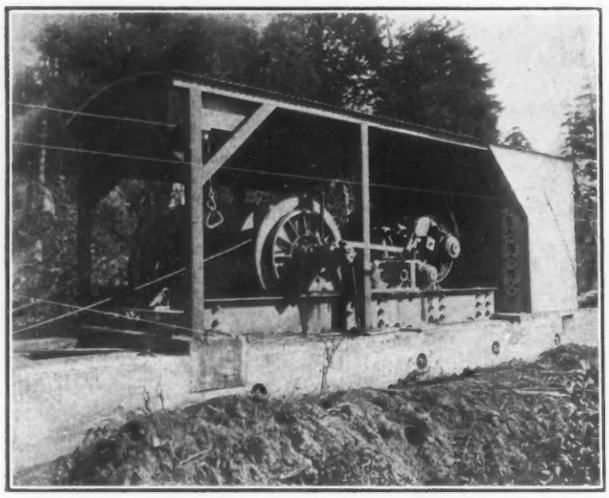


Fig. 1—Electric Logging Machine.

ing-out" cable used to run back the larger line after each load has been pulled in. In coming up to a new position with the machine, this small cable is first run out to the end of the future haul, passed through an anchored pulley block and returned to the machine to be attached to the main cable, which is then paid out in this way. The two cables thus form an endless belt, only one member of which is used, however, for tractive purposes.

The new electric machine, complete with its skids, weighs only 22 tons, whereas the steam-gear apparatus weigh 32 tons each. This difference in weight is of importance when the machines are to be moved about through the field, as is necessary at intervals of about one month. The electric machine is able to drag itself from place to place and up steep inclines by winding up on its cable the other end of which is anchored. Only one man is required to operate the electric logging engine. The steam gear, on the other

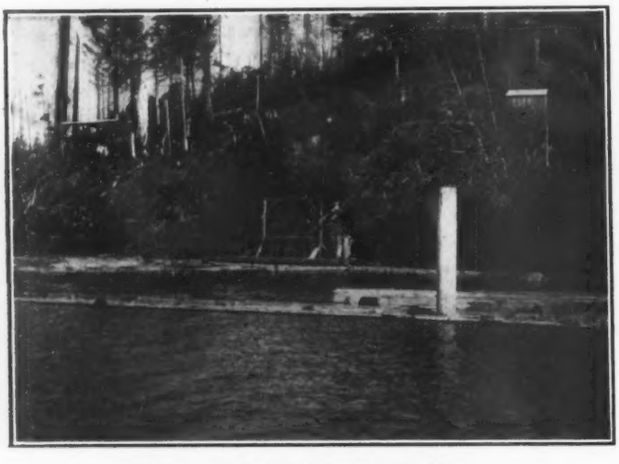


Fig. 2—Electric Logging Machine.

hand, employs an engineer, a fireman and two men to split wood. Thus electric power will mean the saving of about $5000 a year labor for each engine, and this saving in the case of one logging concern alone will amount to $150,000 a year.

A pressure of 440 volts is used at the motors. To serve the logging camps it is planned to build a 11,000-volt transmission line through the field between camps, tapping off from this line and reducing down to 440 volts at a single step. A generating station is to be built near one of the lumber mills, using as fuel the refuse from the saws. About 200 cords of this refuse are now burned daily in the so-called consumers at one mill to get rid of it. The Oregon Power Company, one of the Byllesby interests, is active in promoting the use of electric motors in lumbering as above described.

TESTS OF PORTABLE VACUUM CLEANERS.

By C. A. Pierce.

While corresponding with a number of different manufacturers of vacuum cleaners and their agents the writer was surprised at the small amount of information available. Later, having occasion to test several cleaners for a purchaser, some data, including the following, were collected. Ten portable vacuum cleaners of several different designs were included in the tests, which are not exhaustive since the main object was to find which would do the most rapid and thorough cleaning.

The orthodox method of testing cleaners, especially in competitive tests, has been to place upon or under a rug, divided into plots by chalk lines or otherwise, some dirt, flour or other substance and to find how much of the substance could be taken up in a given time by the different vacuum cleaners. There are many excellent points that can be mentioned about these tests, not the least of which is the demonstration that good vacuum cleaners will really clean, but in a competitive test, especially if the cleaners are at all in the same class, the results must necessarily depend a good deal upon the skill and shrewdness of the competing operators, who are always agents for the cleaners which they operate.

In the following tests a number of nozzles were made with holes of different diameters. These nozzles fitted into one end of a cylindrical chamber and the hose connecting to the vacuum cleaner was fitted into the other end. Water and mercury manometer tubes were fitted to the cylindrical chamber to measure the vacuum. Tests showed that no error of practical importance was introduced due to the way the vacuum gages were connected to the chamber except in the cases where the vacuum was equal to only 1 in. or 2 in. on the water gage. The displacement measurements were made by drawing the air taken by the cleaner through a velocity meter set so that it just filled the cross-

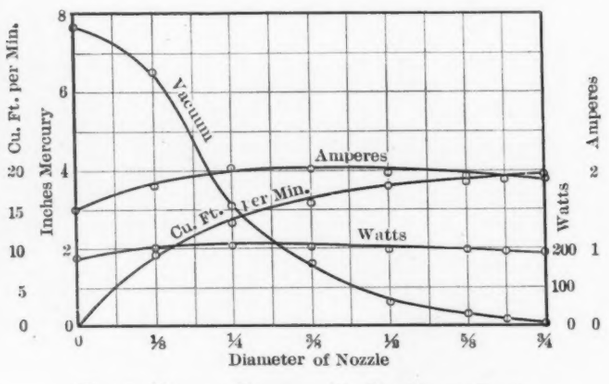


Fig. 1—Vacuum Cleaner with Diaphragm Pump.

section of a heating chamber which could be connected to the pressure chamber described above. The meter was calibrated in position by warming the air as it passed through the heating chamber with an electric heating coil. The rise of temperature was measured with electric and mercury thermometers. Knowing the calories of heat given to the air and the rise of temperature, the volume of air

can be computed. No attempt was made to carry the calibration tests to an unusual accuracy, because each cleaner was tested on the same apparatus. The reproducibility of readings was satisfactory. Calibrating one point on the curve under as nearly identical conditions as was possible on five different occasions, the maximum variations from the arithmetical mean were + 2.6 and — 5.2 per cent.

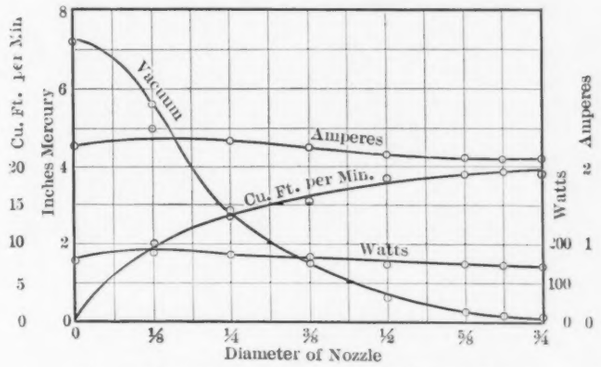


Fig. 2—Vacuum Cleaner with Diaphragm Pump.

But one of the readings could have been legitimately excluded due to extraneous causes, in which case the maximum variations from the arithmetical mean would have been + 1.0 and — 1.5 per cent.

Fig. 1 shows the performance curves for a portable cleaner in which the vacuum was produced by a diaphragm pump. The data are plotted, as taken, with diameters of the holes in the nozzles as abscissas. In Fig. 6 curves are plotted with vacuum and displaced air as co-ordinates. The number on each of the curves in Fig. 6 is identical with the number of the corresponding figure in which diameters are used as abscissas.

Figs. 2 and 3 show the performance curves of two portable cleaners each having a diaphragm pump. Curves for an assembled stationary cleaner with a rotary pump are shown in Fig. 4. The parts for this cleaner were bought separately and assembled. The driving motor was a 1-hp self-starting, single-phase induction machine. The curves in Fig. 5 are for a small portable cleaner with a centrifugal pump.

The curves are fair samples of those obtained for all of

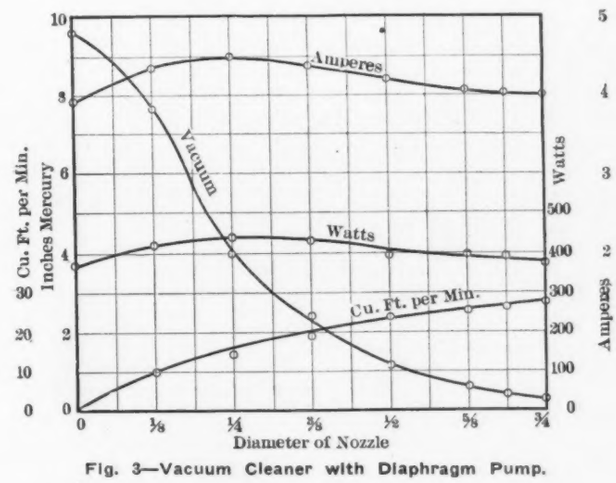


Fig. 3—Vacuum Cleaner with Diaphragm Pump.

the cleaners, the other curves exhibiting no materially different characteristics.

In choosing a line of vacuum cleaners attention should be given to the life of the cleaner, which would include repairs and replacements, to the rapidity and thoroughness of cleaning and adaptability to different kinds of cleaning, to the energy consumption, to the initial cost, and to general points such as noise, accessibility of parts, oiling arrangements, etc. With guarantees such as the more prominent manufacturers of vacuum cleaners give no worry need be felt about the life, though with a less satisfactory guarantee one would be anxious about the abnormal temperatures allowed in the motors. In some types the temperature of the exhausted air reaches alarming values, which depend,

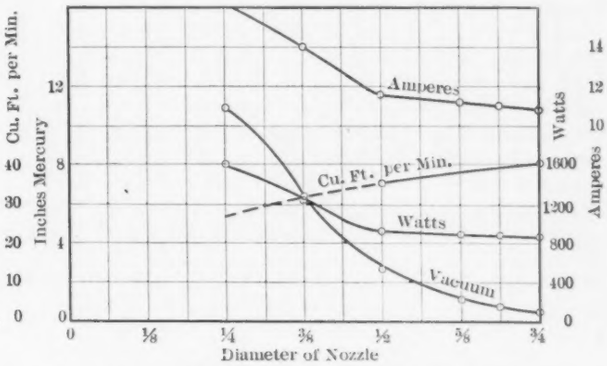


Fig. 4—Vacuum Cleaner with Rotary Pump.

of course, on the length of continuous running. The mechanical parts of the better cleaners are well designed and carefully assembled, and these cleaners will stand a lot of use.

The energy consumption of most portable vacuum cleaners is a negligible factor. The cost is only 4.5 cents per hour (electricity at 10 cents per kw-hour) for the largest portable cleaner tested. The average cost for energy to operate portable vacuum cleaners may be put at from 2 cents to 4 cents per hour.

It is interesting to note that in a cleaner using a diaphragm pump stoppage of the intake hose cannot overload the motor. This is shown by the curves labeled "watts" in Figs. 1 to 3. With a rotary blower or any similar device the watts input increases with the vacuum as shown in Fig. 4. In this case complete curves were not obtained because the motor could not carry the load at the higher vacuums. With the diaphragm pump, on the other hand, it is necessary to have considerable flywheel effect in order to keep the speed variation of the motor during a complete cycle of the pump from becoming excessive.

In general cleaning two different actions are wanted. One is sweeping ability to take up dirt from surfaces and to dust hanging draperies, etc., and the other is ability to clean rugs and the floors under rugs. A test was carried

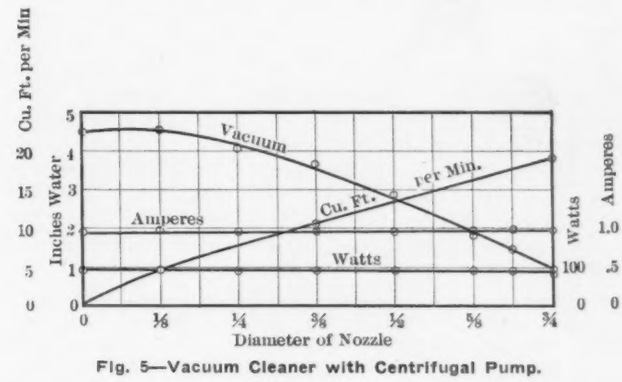


Fig. 5—Vacuum Cleaner with Centrifugal Pump.

out on a good quality Wilton rug to find what vacuum would do satisfactory rug cleaning. The vacuum could be varied by using rug tools of different sizes. It was found that the tool which gave an average vacuum while being used equal to 2 in. of mercury did good cleaning, and one which gave a 3-in. vacuum did excellent cleaning, while a 1-in. vacuum was not satisfactory.

Cleaning ability depends upon the velocity with which air is drawn through the rug or fabric. The relative speeds at which cleaning can be done with different vacuum cleaners can be obtained at any vacuum by comparing the respective air displacements at this vacuum. This is true because the greater the air displacement the larger the area of the mouth of the rug tool which can be used without lowering the vacuum below the value desired.

At a vacuum of 2 in. of mercury the air displaced for the cleaners above, taken in the order of the figures, is 15.8, 14.8, 20.8, 36.7 and zero cu. ft. per minute. At a vacuum of 3 in. of mercury the displacements are 14.1, 13.2, 18.3, 35 and zero cu. ft. per minute respectively. Supposing all rug tools to be made with rectangular mouths having one dimension the same in all cases, the lengths of the mouths of the tools on the different machines to give the vacuums named would be proportional to the respective displacements.

The actual air displaced with the cleaning tool held in the air can be inferred from the curves given because the displacement curves approach constant values as the nozzle

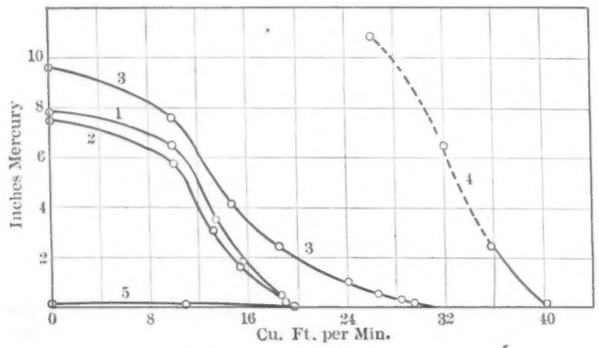


Fig. 6—Relation of Vacuum to Displacement.

diameter is increased. The actual air displaced was in every case considerably less than the computed displacement, showing that the friction of the air in passing through the hose and dust bags was considerable. The only importance of this fact is that the sweeping ability, defined later, cannot be inferred from the computed free air displacement unless a correction of considerable magnitude is introduced to take account of the friction encountered by the air in passing through the cleaner.

Inspection of the curves of Fig. 6 will show that for rug cleaning the working range of e h cleaner, excepting one, is upon the steep part of its vacuum-displacement characteristic. Together with other tools, three rug tools are usually provided with each cleaner. The openings in the tools are supposed to be of different sizes, so that one can use a small vacuum with a moderate air velocity or higher vacuums with higher air velocities, thus making the cleaner adaptable to rugs of varying thickness. In some of the cleaners tested two of the three rug tools had mouths of practically the same area, though the opening in one was larger than that in the other, proving that in these cases there was no apparent reason for having three rug tools.

The sweeping ability of a cleaner is represented by the cubic feet of air displaced with a low vacuum at the mouth of the tool, since a tool is held off from the rug for sweeping. The air displaced at low vacuums can be compared by referring to Fig. 6. It should be said in this connection that there are several vacuum cleaners with centrifugal blowers which give much greater displacements at low vacuums than does the cleaner represented by curve 5, Fig. 6. Although these cleaners do not give high vacuums, yet they are excellent for sweeping operations.

In connection with the determination of the vacuums necessary to clean rugs the corresponding air velocities were also determined. The velocities were 1000, 1900 and 2600 ft. per minute for vacuums of 1, 2 and 3 in. of mercury. One can say, then, that a velocity of from 2000 to 2500 ft. per minute is needed to do good carpet or rug cleaning. Experience extending over six months indicates that this velocity is not great enough to damage rugs. The velocity for good sweeping is higher than this, but it is not easy to set any values, because a small hurricane is needed to pick threads or hairs from a rug, while a very moderate velocity will pick up small pieces of paper or other small particles which do not stick. A carpet sweeper with revolving brushes does "picking up" far better than any cleaner the writer has used.

The portable vacuum cleaner with diaphragm pump communicates considerable vibration to floors unless special provision is made to absorb the vibration. It is not easy to do this, because the moving parts which have a reciprocating motion form an appreciable part of the total weight of a machine.

The prices of the different cleaners cannot be given without identifying the machines tested. It is evident, however, that manufacturing costs do not form a large percentage of the selling prices of the cleaners. In introducing a new appliance it is necessary to spend large sums for promoting the sale and distribution of apparatus. On the other hand, a high selling price restricts sales. With houses wired for electricity as common as they are becoming, it is worth considering whether a substantial vacuum cleaner at a price within reach of people moderately well-to-do would not eventually return greater profits through increased sales.

SPECIFICATIONS FOR BUYING COAL ON A HEAT-UNIT BASIS.

Coal for the ten state institutions supervised by the Wisconsin State Board of Control, amounting to 32,000 tons per year, is purchased on the basis of its heat-unit analysis under specifications prepared by Messrs. Vaughn & Meyer, Milwaukee, the board's consulting engineers. Among the conditions imposed by these specifications are the following:

No coal having more than 14 per cent of moisture, 10 per cent of ash, 40 per cent of volatile matter or 4 per cent of sulphur will be accepted. Fuel must also be practically free from pyrites, slate, stones and other foreign matter. Samples of screenings or small coal are taken from loaded cars by making one trench across the middle of the car and others 4 ft. from each end. These trenches are dug 2 ft. wide and 1 ft. deep measured below the top of the car sides. From each trench at equal intervals along its length five samples are taken, 5 to 7 lb. to the sample, the total coal extracted per car not exceeding 100 lb. Where a car has been partly unloaded trenches are made in the same way across the part of the car not broken into. In sampling from coal piles or bunkers the surface of the coal is first screened of foreign matter and part shovelfuls are taken from a number of points on the slope of the pile, care being exercised to obtain representative proportions of large and small lumps. Samples are also taken from the center of the pile. In sampling lump coal selections are made of representative lumps, which are in turn broken up and an egg-size sample is retained from each. At least 200 lb. is required for such a test sample of lump coal.

After the sample is collected it is prepared on a clean, hard concrete or iron surface, the lumps being broken up into pieces ½ in. in diameter. The pile is kept circular in form and is thoroughly mixed, after which it is divided with shovels into four equal quarters, opposite quarters being retained while the remainder is returned to the bins. The process of mixing, breaking and quartering is continued until the pieces are reduced to the size of grains of

corn, the final sample being put into three air-tight cans, one to be kept by the purchaser, one by the contractor and the third sealed for record.

Payment is made on the basis of cents per pound-Fahr. heat unit according to the formula

Cents per heat unit =

$$\frac{\text{heat units per pound dry coal} \times \text{per cent dry coal} \times 2000}{\text{bidder's price per ton} + (0.5 \times \text{per cent ash, in cents})}$$

The adjusted price to be paid the contractor is determined by multiplying the number of heat units per pound of dry coal by the percentage of dry coal (100 per cent minus per cent moisture in delivered coal) and by 2000, dividing the result by the cents per heat unit and subtracting from the quotient one-half the percentage of ash expressed as cents. Expressed as a formula, the price equals

$$\frac{(\text{heat units per lb. dry coal}) \times (\text{per cent dry coal}) \times 2000}{\text{cents per heat unit}} - (0.5 \times \text{per cent ash, in cents}).$$

Where the sulphur found exceeds by more than 1 per cent the quantity contracted for or produces bad firing, the coal may be rejected or the price reduced 3 cents per ton for each per cent increase in sulphur above specifications. To cover the increased cost of shoveling 10 cents per ton will be deducted from the payment price of all coal delivered in box cars.

THAWING WATER PIPES WITH ELECTRICITY.

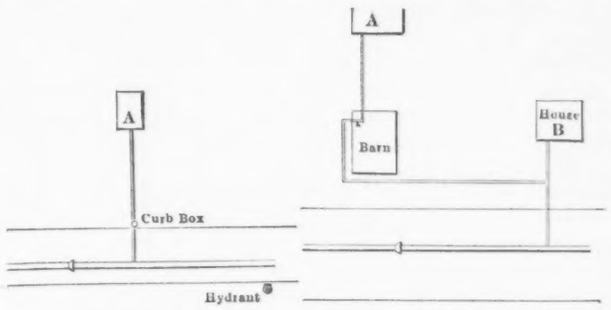
By T. T. Logie.

The continued cold weather of the present winter has offered to central stations numerous opportunities for the sale of energy for the purpose of thawing out frozen water services.

The accompanying sketches show some results obtained by Mr. G. H. Caffrey, superintendent of the Norwalk division of the United Electric Light & Water Company, with this class of work. An equipment consisting of a 15-kw transformer, 2300-volt primary to 110-volt secondary and a water-barrel rheostat was used. The conductivity of the water in the barrel was increased by the addition of salt, about 10 lb. of salt to the barrel being sufficient. Labor expended in handling was reduced to a minimum by arranging the entire equipment on a wagon.

The service shown in Fig. 1 consists of 100 ft. of 1-in. pipe, laid on a grade of about 20 deg. To reach the street end of this pipe it was necessary to dig down to the main at a point marked *A* in the sketch. At this point one end of the secondary line was attached, which fed through to the point *B*, where the secondary circuit was closed. About 150 amp at 60 volts was allowed to pass through this pipe for twenty-five minutes before water was obtained.

The conditions met with in the service represented by Fig. 2 differed from those above in that the length of pipe was double, the grade very slight and the pressure low. Connections were made in the secondary circuit at the point *A* and on the valve in the curb box, this latter connection being made by pushing down a hooked wire into the box and snapping the hook onto the wheel of the valve. From 100 amp to 200 amp at 60 volts was sent through this pipe without result other than heating the pipe. The main was then uncovered and the secondary connection removed from the curb box to the main. This resulted in water flowing within ten minutes, the frozen section being in the goose-neck trap which extended upward into frozen ground.

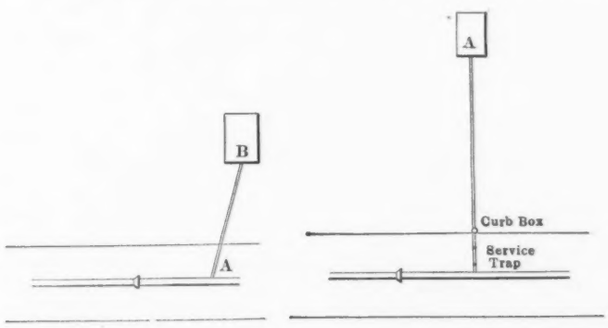


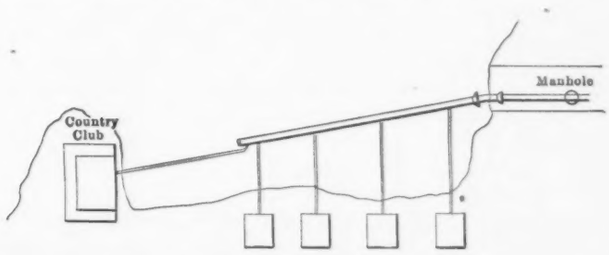
Figs. 3 and 4—Methods of Thawing Water Pipes.

A third station differed from the foregoing in that a fire hydrant could be used in closing the secondary circuit. With another connection made at *A* and current passing through the pipe for two hours no water was obtained. A connection was then made on the curb-box valve by the method mentioned above, with the result that water flowed freely within five minutes.

The house shown in Fig. 4 receives its water from two sources, namely, the street main in front of the house and through a barn and a house service on an adjacent street. The service from the house marked *A* to the barn being free, it was a simple matter to thaw the remainder of the service from the barn to the house marked *B*, by making a connection in the barn and another under the sink in the house. Water flowed in this section after heating the pipe for four minutes. Another pipe leading upstairs was also frozen, but by transferring the barn connection of the secondary to the pipe upstairs it was cleared within two minutes.

A problem presenting unusual conditions was met in an unsuccessful attempt to thaw a 4-in. main of 1000 ft. This main is laid in the salt marshes of Norwalk Harbor and feeds the Country Club and several cottages, it being completely covered with salt water at high tide. The first attempt was made with an equipment of two 15-kw, 2300/100-volt transformers connected in parallel. A current of 3000 amp at about 5 volts gave no results. At the next tide the transformer connections were changed so that in series they allowed a current of 300 amp at 100 volts to pass through the pipe. This latter method was tried at intervals for several days until it was evident that the distance was too great to attempt between tides and that the salt water offered too much conductivity to the current to secure the proper amount of heat, when the attempt was abandoned.



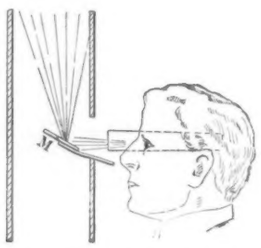


Figs. 1, 2 and 5—Methods of Thawing Water Pipes.

Letters on Practical Subjects

EXAMINING PARTITION INTERIORS.

A pocket flashlamp and a little mirror are the only apparatus required to inspect the interior of a wall or partition which would ordinarily be inaccessible. For fishing wires, retrieving cable and inspecting finished work, this use of the lamp and mirror provides a labor-saving "kink." The mirror has only to be introduced in the outlet hole in



Examining Partition Interiors.

the wall, the flashlamp and eye being held behind it as illustrated. The mirror reflects the light of the lamp onto the place to be illuminated, at the same time reflecting the image back to the eye near the lamp. The usefulness of this little device is as great as its simplicity.

Cleveland, Ohio. WILLIAM SPRUNT.

LACING LEATHER OUT OF SCRAP BELT.

By a very simple and neat method all scraps and pieces of lacing leather out of which a straight length cannot any more be cut can be so manipulated that not much of it need be wasted, provided, however, that a circle of at least 4 in. can be inscribed on the scrap. All that is needed is a razor edge pocket knife and a nail. As closely as can be approximated drive the nail through the center of the piece of leather into the board. At a distance from the nail equal to the smallest radius stick the knife blade into the board, inclining the edge away from the operator, assuming him to be back of it. Then, by drawing the leather toward himself and using the nail as a center of rotation, a perfect circle can be cut out. Do not complete the circle, but, as the knife blade approaches to ¼ in., or as wide as the lace will be ultimately, of the end, stop. This will give a starter for the real operation. Now remove the nail, but leave the knife blade in its original position. With the almost completed circle still in position place the thumb of the right hand on the board and at a distance from the blade equal to the width of the lace to be cut, and with the other hand take hold of the almost severed piece and pull. Be sure to exert a little pressure on the leather with your thumb as you draw away. Continue pulling until the diminishing circle vanishes, when you will find that out of what once appeared to be nothing but scrap comes a lacing leather several feet long.

Joseph, Ore. J. J. REZAB.

HORSE-POWER CURVES FOR USE WITH ELECTRIC METERS.

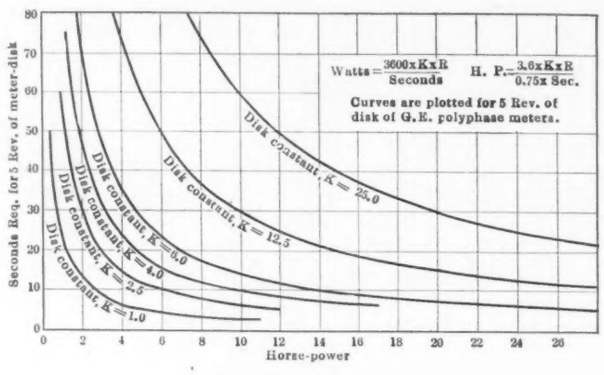
Everyone connected with the central station is, of course, familiar with the meter test formula:

$$\text{Watts} = \frac{3600 \times K \times R}{S}$$

in which K is the disk constant of the meter, R the number of revolutions of disk and S the seconds required to make R revolutions.

With a slide rule it is the matter of only a few seconds to solve this formula in terms of horse-power, but by use of a curved sheet, reproduced in the accompanying cut, which is made just the right size to fit a motor solicitor's price book, the result can be immediately determined by inspection with sufficient accuracy.

For example, if a meter having a disk constant K of 12.5 takes thirty seconds for five revolutions of the disk, we


Watts = 3600xKxR / Seconds
H. P. = 3.0xKxR / 0.75x Sec.
Curves are plotted for 5 Rev. of disk of G.E. polyphase meters.
Disk constant, K = 25.0
Disk constant, K = 12.5
Disk constant, K = 8.0
Disk constant, K = 4.0
Disk constant, K = 2.5
Disk constant, K = 1.0
Seconds Req. for 5 Rev. of meter-disk
Horse-power
0 2 4 6 8 10 12 14 16 18 20 22 24 26
0 10 20 30 40 50 60 70 80

Horse-Power Curves.

see by consulting the curve for this value of K that the load upon the meter is 10 hp, which is correct within 0.05 hp.

For a pocket size a high degree of accuracy in these curves cannot be expected, nor is it necessary; but if carefully plotted on a larger scale very close readings can be obtained.

Fall River, Mass. FRANCIS S. ROOT.

CONCRETE IN POWER-HOUSE WORK.

The working engineer who has occasion to do a bit of construction work now and then may, by means of a very little study, fit himself to use reinforced concrete to advantage even in little jobs seemingly unworthy of the dignity of reinforced construction, for there is no reason why the benefits of reinforced-concrete construction should not be had in small jobs as well as in large work.

Reinforced construction is applied to concrete operations for at least two reasons, cheapness of construction and prevention of steel corrosion.

Steel may be laid down in construction for approximately 5 cents per lb. Concrete, at 150 lb. per cubic foot and $8.10 per cubic yard, will cost $0.002 per lb., or 5 lb. for 1 cent. Therefore concrete is twenty-five times as cheap as steel. The cost of concrete per yard varies in different localities. It was assumed as $8.10 per cubic yard because that is a fair average figure and one which comes out in even money. For other localities, where the cost of concrete is greater or less, it will be necessary only to multiply the above figures by the relative ratio of cost in order to obtain a true basis of comparison between steel and concrete costs.

Concrete can be used only to carry compressive loads, while steel may be used to carry both tensile and compressive stress. The cost of all steel construction to carry both kinds of loads is considerable, and in addition the steel, being exposed, is subject to decay by rusting out under the action of moisture and certain gases and salts.

Concrete can be depended upon to carry loads of 1500 lb. per sq. in. in compression, while steel will safely carry loads of 15,000 lb. per sq. in. in tension. Therefore, if a beam be designed with sufficient concrete at $0.002 per lb. to carry the compression, and with sufficient steel at 5 cents per lb. to carry the tension, the cheapest possible beam will have been provided and there will be the additional good effect that the steel, inclosed in the concrete, will be perfectly protected from all corrosive effects whatever, fire included, and will remain clean, strong and bright for ages unless affected by electrolysis. When the engineer desires to bridge over space with concrete he must use

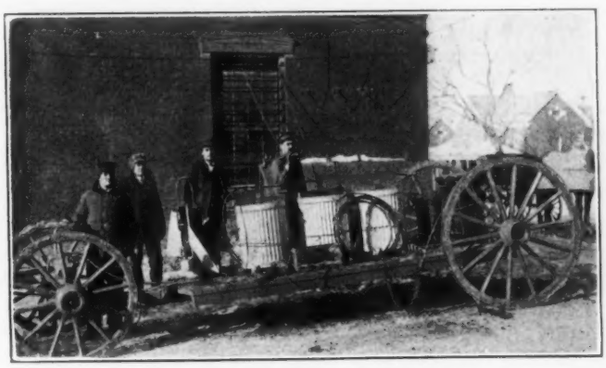
the arch in order that the concrete may be at all times in compression. But steel will permit a flat arch to be made, with the upper portion in compression, the lower portion in tension, and, generally speaking, there is need of only about 1 per cent of steel area in any given mass of concrete. To be sure, more will be required for certain things, but 1 per cent will serve as a fair average. For example, the bridging over of the space between the foundation of an engine and the wall of the building—say, 6 ft. distance—would require a bridge 2 ft. wide and capable of carrying any ordinary load up to 400 lb. to the square foot. To do this with an arch will require an average depth of 3 ft. of concrete—more at the ends and less at the middle of the arch. This will be 1⅓ cu. yd. of concrete, or 5400 lb., which at $0.002 comes to $10.80. With reinforced concrete a beam 24 in. wide and 12 in. thick will be required, together with 0.01 per cent of steel disposed along the lower side of the beam. The mass of a beam 6 ft. by 2 ft. by 1 ft. will be 12 cu. ft., of which 1 per cent, or 57.6 lb., will be steel and 99 per cent, or 1872 lb., will be concrete. The cost of the reinforced bridge will then be: 57.6 lb. steel at 5 cents, $2.88; 1782 lb. concrete at 2 cents, $3.57; total cost, $6.45.

The saving in the above example is the difference between $10.80 and $6.45, which is $4.35. This is nearly one-half the cost of the concrete arch.

Boston, Mass. M. C. RICE.

ELECTRIC THAWING OUTFIT.

The accompanying illustration is not, as might reasonably be inferred from the very prominent location of the ash cans, a photograph of a "white wings" street-cleaning outfit. Out here in Kansas, as elsewhere, records for low temperatures have been broken this winter, and while ordinarily the freezing of water pipes has not been a very serious matter at the Fort Leavenworth army post, the extreme and long-continued cold has been productive of much serious trouble on that score. Previous to this season no electric pipe-thawing outfit seemed to be really needed, but conditions this winter became such as to make necessary the hasty assembling of such apparatus and materials out of stock on hand, resulting in the very crude, but, as it proved, highly satisfactory, arrangement shown. The only apparatus available were a 5-kw Wagner and a 7½-kw Westinghouse transformer, the ash cans for water rheostats, a 150-amp Wright indicator for ammeter, and a pole-line service cut-out with fuses only. Connection was made to a 2280-volt, 60-cycle pole line through primary fuse blocks. It required 127½ amp at 110 volts to thaw out the



Pipe-Thawing Outfit.

most stubborn case in thirteen minutes. The shortest time on any pipe was five and one-quarter minutes. These were all ¾-in. galvanized pipes. The decided efficiency of the arrangement was a very pleasant surprise to every one.

Mr. Junior Parrish, the post electrician, is shown standing just in front of the Wright indicator; Mr. John Scanlon, his first assistant, is at his left; the driver is at his right, and Private G. C. Jones, Company I, Third Battalion Engineers, U. S. A., one of three soldier assistants, is at the extreme left of the photograph.

As showing what may be done with illustrated and scattered materials in times of urgent necessity, the photograph may be of interest to others.

Fort Leavenworth, Kan. JUNIOR PARRISH.

CARE OF STEAM GAGES.

It does not look well to see in an engine-room or boiler-room several steam gages each indicating differently. When one instrument points to 110 lb. and another indicates 125 lb. pressure, each being connected to the same steam main, it is time to doubt if either gage is recording correctly. True, the manner in which a gage is connected will have a great deal to do with the indication of pressure, for a pair of gages may be so connected that they may record a 10-lb. difference and yet each may indicate correctly. When looking over a number of gages with the idea of testing them so they will all read alike the peculiarity noted above must be considered and the cause taken into account. That cause will be usually found to be the static pressure of the column of water in the pipe above the level of the gage. For instance, two gages are connected to the same boiler, one being placed above the boiler with only a "gooseneck" and a valve intervening between the instrument and the steam generator, the other being 100 ft. away from the boiler, in a cellar, where the pipe connecting the gage and the boiler runs to the top of the building, which has a flat roof, and then descends to the instrument in the cellar. The distance between the horizontal pipe and the gage vertically is 22 ft. The gage in the cellar indicates about 10 lb. more pressure than the gage at the boiler, and this excess of pressure is due entirely to the static pressure of the column of water in the pipe above the level of the gage. That this is the cause of the extra pressure is easily proved by bleeding the vertical pipe until all the water has run out, leaving nothing but steam in the pipe. Then it will be found that the gages indicate alike, provided, of course, that they are both correct.

Steam gages are easily kept in condition if the engineer will only compare each one periodically with a master gage, which in turn should occasionally be sent away for comparison with a mercury column. All good makes of steam gages contain means for adjustment so they may be made to work in unison with a master gage. Recording gages also are made with means of adjustment. Gages of this class often become deranged through freezing or by admittance of live steam to the spring. The latter is the most common cause of a spring going "light," that is, indicating more than the boiler pressure.

A recording gage should always be attached to the piping by means of a union immediately below the gage. The upper part of the union should be drilled about 1/16 in. for the admission of pressure, while the lower portion of the union should have a hole not more than 1/32 in. in diameter. When capillary connections are thus arranged it is seldom that the gage spring is affected either by steam or by freezing, as little water or live steam can find its way through the small hole and the small quantity of air confined in the pipe above the union is forced into the gage and made the medium of pressure transmission to the spring. Should the union become leaky, water instead of air may be forced into the gage spring, and then there is much more danger from freezing than when air alone is permitted to enter.

When a recording gage fails to register with a steam gage both gages should be compared, readings being taken every 5 lb. with an increasing pressure, then similar readings with a falling pressure. It is sometimes found that there is more variation in the increasing pressure readings

than in the readings when the pressure is falling. When such is found to be the case it may be due to the lost motion in the gearing of one or more of the gages.

To adjust the recording gage the pointer should be moved, either by shifting the rivet or by bending the pointer, until the latter is brought to zero at atmospheric pressure. Then the gage should be connected to some controllable source of pressure and the readings of the two gages compared, that is, the recording gage and the steam gage on the boiler, or master gage.

All that is necessary to obtain the necessary controllable pressure is to connect the two gages to the same steam pipe and to see that there is a valve between the gages and the boiler. Then steam can be admitted to the pipe and the pressure may be run up, by a proper manipulation of the steam valve, to each 5-lb. mark and held there as long as is necessary for proper comparison of the two gages. The comparison may be readily made to a falling pressure by merely closing the steam valve leading to the boiler and then "bleeding" the gages. If there is no valve for the purpose of letting off pressure in the gage, the gage may be unscrewed a little, and the leakage thus caused will quickly reduce the pressure to the desired point. Ordinary steam gages are adjusted so as to register with the master gage at various pressures, by increasing or decreasing the leverage of either the geared segment or one of its connections, means usually being provided for that purpose in the construction of the gage. All gages that are not provided with means for such adjustment are of so cheap a variety that they should not be purchased but should be rejected in favor of a better type of gage.

Boston, Mass. JOHN JONES.

COLLEGE TEACHING OF INTERIOR WIRING.

As the electrical industry progresses and the mystery formerly shrouding the methods of the electrician becomes somewhat dissipated by more general familiarity with the uses of electricity, there is a growing demand for workmen of approved ability. The estimation of installation costs is still, too frequently, a matter of guesses, whose accuracy is a subject for later self-congratulation or otherwise by the electrical contractor.

It is coming to be felt that the kind of training, in accuracy and observation, furnished by our higher schools has a real place in the interior wiring field formerly filled by the natural "genius." We find college graduates sought by contracting firms as ultimate estimators, foremen and superintendents. The pay is not large, but this is largely a fault of competition on a guesswork basis which these very men will help to change. The demoralization of electric wiring by price-cutting has become so serious in some localities that, in the absence of united action by contractors, the lighting companies must naturally take up interior wiring in self-defence.

Recognizing these conditions, many colleges are adding to their electrical engineering instruction practical experience in wiring, together with study of the National Electrical Code and occasional lectures by experts on estimation or wiring methods. In this manner men are graduated who, without the bias toward some obsolete method which long experience sometimes and unfortunately gives, have facility in handling the interior wiring problems, and knowledge of such materials and uses as constitute valuable adjuncts to their technical training.

Possibly in no part of the country have existing conditions made a stronger impression on the colleges than in the West. There state colleges usually include some instruction in interior wiring, and turn out many valuable helpers in the art. The University of Wyoming, the University of Colorado, the Colorado School of Mines, the Colorado State College, the Colorado State Agricultural School and the University of New Mexico all have taken up this work, and the changed attitude toward interior wiring is very apparent in these States as a result partly of this study. Boulder, largely from the influence of the University of Colorado, there situated, has just made effective a conduit ordinance. Antagonism toward betterment of wiring practices has practically ceased throughout the Rocky Mountain territory, and the degree of permanence noticeable in new installations throughout this field will compare favorably with that of the older and presumably more instructed Eastern communities.

Denver, Col. C. J. WILLIAMS.

DEFECTIVE BOILER SETTINGS.

A person who has not seen the matter demonstrated by actual test will scarcely be able to understand the immense heat losses caused by defective boiler settings. Not only is there great loss when the setting is poorly designed or badly built, but there is great loss in some settings through air cracks between the bricks and even through some bricks which are very porous—"soft," such bricks are technically designated. Bricks which have not been burned closely enough to the vitrifying point are so porous that air may often be blown through them by the breath. Indeed, it is not an impossible "stunt" to blow air enough through an 8-in. brick wall with the breath to move a light silk handkerchief that has previously been suspended upon the other side of the wall.

When bricks of such porous character are used for a boiler setting it is safe to estimate that at least 10 per cent of the heat of the fuel burned is wasted by escaping through the soft bricks, or is lost by ingress of air which cools the gases or damages the combustion by increasing the amount of carbon dioxide which escapes during the imperfect combustion caused by cold air admitted in the wrong place in the furnace and at the wrong time. Only well-burned bricks should be used for boiler setting, and the joints should be exceedingly well filled with a thin mortar which is used upon wetted bricks in order that each hole and corner may be filled to the limit. The ordinary bricklayer who has only laid dry walls at so much per thousand bricks must take a few lessons before he can build a boiler setting which is airtight.

The experienced engineer who is about to conduct an evaporative test, particularly if he desires to show the highest possible efficiency, will carefully go over the entire boiler setting and fill each crack, no matter how minute, through which air can enter the boiler setting. The various

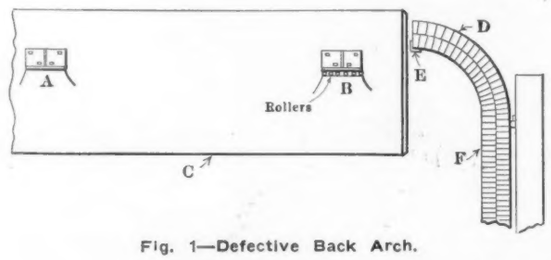


Fig. 1—Defective Back Arch.

castings and furnace fittings will likewise be carefully "daubed" with mortar, clay wash or calcined plaster (plaster of paris) or some other substance which will effectively close the openings against the entrance of outside air.

The arch above the level of the tubes at the rear of a fire-tube boiler is sometimes responsible for a lot of trouble, not only in the line of admitting air, but even to pushing the boiler out of place, cracking the setting and otherwise demoralizing the steam plant. A diagrammatical arch is shown by Fig. 1, herewith, and while the engraving repre-

sents neither a very good nor a very bad arch, it will serve the purpose of pointing out defects which should be closely looked after by the engineer who is responsible for fuel efficiency.

The boiler *C* is supported upon the lugs *A* and *B*, the former being placed solidly upon a wall plate and closely bricked in, while lug *B* is placed upon rollers which are free to move upon a metal plate placed underneath them as the boiler moves during expansion and contraction. But here is where the back arch comes in. In order that the boiler *C* may lengthen, there must be space at *E* between the arch and the boiler shell. If there be some space left here it makes a fine place for air to enter and pass directly into the boiler tubes, and this is a most damaging occurrence. It not only wastes heat, but is very apt to cause leaky tubes as well.

In order to make an effective junction between the arch and the shell of the boiler there should be two metal plates so arranged that one is fixed to the boiler, the other to the setting, and the plates being free to slide, one over the other, there is no chance for air to enter or for dirt to get packed between the rear arch and the head of the boiler. Such a thing has happened many a time and in more than one instance the writer has seen boilers with a stick of timber propped against the setting to act as a brace for keeping the boiler from working its way out of its setting. Something must give when the joint between the back arch and the head of a boiler becomes packed full of solid material. More falls in and packs when the boiler contracts; then, when it expands again, either the shell is driven ahead or the arch and the back end of the boiler setting is pushed outward. The rear arch should be so designed and constructed that it will neither leak air nor pack full of dirt and crowd the boiler out of bed.

The construction of a good back arch is not a simple matter by any means. It is hard to fasten bricks in place without iron supports to carry them, but if iron supports are used they are quite apt to burn out and let the arch fall. Perhaps the best arch supports, when plain bricks must be used, are stout cast-iron angles. Cast iron stands up under heat better than wrought iron or soft steel. A pattern made of exactly the right size and length for the arch forms the very best way of keeping satisfactory arch bearers always on hand. Then, when the arch shows signs of flatting down, a couple more bearers may be put in and the brick laid over again.

A form of back-arch construction which is used a good deal in some parts of the country consists of a cast-iron angle similar to that shown in Fig. 1, but there are cast-iron circular rafters, etc., to receive and hold the firebricks which form the arch proper, the bricks being laid loosely between the cast-iron rafters until the quadrant is full. The central portion of the brick projects below the iron and it is supposed that the brick thus projecting below the metal will protect that material from the heat to a considerable extent. This is the case and a back arch thus constructed stands the heat much better and longer than one with the bricks just flush with the upper surface of the iron castings.

One great benefit to be derived from the use of a back arch constructed in this manner is that no forms are necessary for its construction. There is no time lost in building up underneath and preparing a suitable surface to lay the bricks against that they may be laid to the desired curve. The beam and rafter method is quick and time is saved in repairs as well as in first construction.

In one instance the writer got himself and the boiler out of trouble by using the method depicted in Fig. 2. At this job there was no brick whatever of the fire variety, and none could be obtained for days. Behind the power house was found a pile of old paving bricks. They were some which had been condemned by paving inspectors and were in the main fine hard brick, the defects being chiefly in the line of chipped corners, broken ends or edges, with now and then a broken brick. A further rummage around the premises revealed a quantity of twisted steel bars—Ransome bars—such as are often used in reinforcing concrete. One of the bars is shown at *D*, Fig. 2. A couple of scantlings were placed on end back of the boiler and planks were laid across the scantlings, resting also upon pieces of 1-in. pipe thrust into the upper tubes of the boiler. A few grain sacks were placed on top of the lumber; then some sand was shoveled in and packed down until it approximated the shape to be given to the inside of the arch.

A lot of old paving bricks had been brought in and were

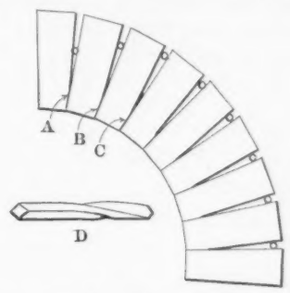


Fig. 2—Back Arch of Paving Brick

being chipped at one end, as shown at *A, B, C*, by two laborers who were quickly taught how to chip the bricks without breaking many of them. Next, a little fireclay was brought out and added to by mixing with it some old firebricks which were pounded up.

When pulverizing old firebricks one should never make the mistake of trying to pound all of the material fine enough to pass through the No. 8 foundry riddle, which is the proper sieve to use in screening fireclay and brickdust for fire mortar. It takes too long to pound up all the little bits of brick in a lot, so just let them go. Put the firebricks into something solid—a stout box or a casting of some sort—then pound the bricks with the end of a bit of shafting. After hammering a few minutes pour out the material and pass it through the riddle. All the fine particles will be removed by this action, and the coarser particles, not being supported by finer material, are more quickly broken than when packed with fine material. Thus it pays to pound a little and screen often, returning the coarser particles to the pounding box for more hammering, and repeating the process several times.

With sufficient mortar material at hand, proceed to lay the lowest course of brick in the arch to be constructed. The inner ends of the bricks will come together, while the outermost ends must be blocked up with something. For this purpose we placed one of the twisted rods on the lower course of chipped bricks, put on a little mortar and went ahead with the second course. As the arch approached the boiler the bricks stood more and more vertical and the rods did a good deal toward keeping the bricks from falling inward after the arch became old. If thought desirable, shallow grooves may be cut in the bricks to receive a segment of each rod; then it will be mechanically impossible for a portion of the arch to cave in, unless the whole structure goes together.

The writer has put into service several paving-brick back arches, and they stand the strain about as well as firebrick. Paving bricks can also be used in case of emergency to line a boiler furnace with, but they do not last as well as firebrick for that purpose, although they will last for a long time when the boiler is not forced to its capacity. As noted in the above paragraphs, each crack between the bricks must be filled, and it is much better not to leave large joints. "Butter" the bricks, then rub them well together, and the wall will be tighter and will stand fire much better than is at all likely to be the case when the wall is laid with thick joints.

Willoughby, Ohio. JAMES F. HOBART.

Questions and Answers.

Kindly favor me with a short explanation of a "phantom" circuit with reference to telephone lines. H. M. G.

The term "phantom" is applied to a third circuit that can be made by combining two metallic telephone circuits operated separately and independently. The outgoing phantom circuit consists of the two wires of one metallic circuit, while the return phantom circuit is completed by the two wires of the other metallic circuit. Connections to the metallic circuits are made at neutral points formed by means of inductive coils shunted across the line in such a way that they offer large shunt impedance for the phantom telephone current.

What information does a controller manufacturer require to furnish a speed controller for a shunt-wound motor the speed of which is to be varied by varying the current throughout the armature? F. C. W.

In order that a controller manufacturer may provide you with the equipment desired for varying the speed of a shunt-wound motor, it would be necessary for you to specify the horse-power rating of the motor, the required variation in speed and the voltage of the circuit. It would probably be to your advantage, before placing an order for a controller, to obtain catalogs and price lists from several manufacturers. These catalogs give much information of the character which you desire.

I have a 220-volt, two-phase induction motor with four leads at the terminal board and desire to connect the motor to a three-wire, two-phase service. How may this be done? W. F.

In a three-wire, two-phase system one of the wires is used as a common conductor for two of the phases. That is to say, the emf of one phase is derived from this common wire and one outside lead, while the emf of the other phase is derived between this same common wire and the remaining outside lead. The two wires of one phase of your motor should be connected between one outside lead and the common conductor, while the other phase should be connected between the other outside lead and this common conductor. If the motor is of the true two-phase type, with separately insulated phase windings, it will operate properly. The direction of rotation of the motor will depend upon exactly the same conditions upon which it depends when four separate wires are used instead of three wires. That is to say, if after having been connected up the motor revolves in a reverse direction it can be caused to revolve in the proper direction by interchanging two of the leads of either of the phases of the machine.

Will you kindly explain the meaning of the following: "Less than 100 hours connected load, 2 cents"? What is meant by 100 hours? Does it mean kw-hours or hp-hours? Also explain the meaning of connected load. What is meant by maximum demand in the following clause: "Less than 100 hours maximum demand, 1¾ cents"? C. W.

The expression "Less than 100 hours connected load, 2 cents," would have to be interpreted in connection with other portions of the rate schedule with which it was used. However, it probably would be intended to mean that when the energy consumed per month was the equivalent of the use of the total rated connected equipment for less than 100 hours the rate would be 2 cents per kw-hour. The expression "Less than 100 hours maximum demand, 1¾ cents," would probably mean that when the consumption of energy is equivalent to the use of the maximum demand amount for less than 100 hours per month the rate would be 1¾ cents per kw-hour. The term connected load would mean the sum of the total ratings of the connected apparatus, while the maximum demand would mean the total amount of power consumed by the connected load at any one given time. The maximum demand would, therefore, differ from the connected load, in view of the fact that at no time would all of the connected equipment be in service simultaneously.

Why is it that direct-current generators are limited as to voltage? Where can information on the theory of the high-tension direct-current system be found? Where can woven-wire brushes be purchased? R. J. K.

The limit to the voltage at which direct-current generators may be operated is determined by the commutator or current-collecting device. An article descriptive of a high-tension direct-current system used in Europe was contained in our issue dated Oct. 20, 1906. The system as described was operated to transmit energy 87 miles at a maximum emf of 60,000 volts. As noted on page 867 of our issue dated Oct. 7, 1909, the equipment has been arranged and added to so that it may be operated with 150 amp at 100,000 volts. Woven copper brushes are made by a number of companies and can doubtless be found in any first-class electric supply store.

Will you kindly advise me of the names of the companies operating electric-light plants in the United States that are paying a percentage of their gross receipts to the cities in which they are operating, and also, if you have the information, will you please give me the percentage of the gross which is paid? S. D.

The most notable example of a company of this kind is the Commonwealth Edison Company of Chicago, which, according to an ordinance passed by the Chicago City Council on March 24, 1908, is obliged to pay 3 per cent annually of its gross receipts to the city treasury. The Great Falls Power Company received a franchise from the city of Nashville July 18, 1902, for a period of thirty-five years, in which it was stipulated that the company was to pay the city, in lieu of all taxes except ad valorem taxes, an amount equal to 2 per cent annually upon the first $50,000 of its gross receipts, and 3 per cent on all over $50,000, derived from the sale of its electric energy within the corporate limits of the city. The Rockford General Electric Company, by an ordinance granted Feb. 6, 1899, by the city of Rockford, Ill., and amended in several particulars in 1908, agrees to pay to the city 2 per cent of its annual gross receipts from commercial lighting over and above $94,000, on the condition that if any other company should in the future be required to pay less, this percentage should be proportionately reduced. Under the general laws of the State of Kansas governing cities of the first class, every electric light and power company is required to pay into the city treasury 10 per cent of its net earnings over and above 10 per cent earnings on its investment. Under the terms of a franchise granted by the city of Wichita to the Wichita Gas, Electric Light & Power Company, the grantee agreed that on July 1, 1911, the City Council should have its choice of receiving 1 per cent of the gross earnings under the franchise or 10 per cent of the net earnings over and above 10 per cent upon the investment. On May 15, 1906, the Denver Gas & Electric Company secured a twenty-year franchise, in which it agreed to pay into the city treasury until the end of the year 1907 all of its gross receipts from the sale of electricity for lighting purposes in excess of an average of 7.5 cents per kw-hr.; during 1908 and 1909 all in excess of an average of 7.1 cents per kw-hr.; during 1910 and 1911 all in excess of an average of 6.7 cents per kw-hr.; during 1912 and 1913 all in excess of an average of 6.3 cents per kw-hr., and during 1914 and thereafter all in excess of 6 cents per kw-hr. By an ordinance approved Dec. 26, 1906, the city of St. Paul, Minn., granted a franchise to the Northern Heating & Electric Company for a period of twenty-five years. This franchise as granted was expressly subject to all the conditions and obligations contained in the city charter, including the filing of a financial statement and the payment of an annual license fee of 5 per cent of its gross earnings. We believe that the Narragansett Electric Light Company, of Providence, R. I., operates under an agreement with the city to divide its earnings with the city whenever its dividends are above 8 per cent.

Central Station
Management, Policies and Commercial Methods

ELECTRIC DRIERS IN THE DYE SHOP.

In textile mills after the finished hose or socks have been dyed they are commonly drawn over foot-shaped boards to dry. For years it has been the practice to draw the footwear over these boards, at the risk of tearing it. Recently, in several progressive mills, electrically heated brass foot models have been substituted for the older boards with much success. Each brass "foot" contains a 500-watt heating unit, keeping it quite warm, so that the dyed fabric dries in a fraction of the time before required. A dozen or more of these inverted "feet" are mounted on a bench before the workman, who can slip the socks on and off the slippery brass surface with the minimum of trouble. The foot lasts are constructed with interchangeable toes, so that by screwing on different end pieces several sock sizes can be dried. The introduction of the electric driers has practically halved the cost of drying, and a single operator now handles twice as many pairs as before. The brass surface offers no projections or slivers to tear the hose, and as the result, "seconds" and spoiled pairs are entirely eliminated.

LIFTING LOADED FREIGHT CARS BODILY WITH ELECTRIC HOIST.

In the erection of the approaches for the new St. Louis municipal bridge across the Mississippi River electric hoists are used to lift loaded freight cars, trucks and all, from the lower railroad tracks, depositing the cars on the runway level, 112 ft. above, where a switch engine pushes them to the point where they are to be unloaded. Standard flat cars loaded with steel and other materials are handled in this way, some of the cars with their loads totaling 160,000 lb. The trucks are chained to the car bodies before lifting them from the lower tracks. By hoisting the loaded cars bodily in this way the time and cost of handling the material twice and hoisting it piece by piece are saved, the loaded cars being deposited directly at the work where they are to be unloaded. The main hoist motor is of the 440-volt alternating-current type, although the auxiliary motors used to spot the cars in position on the rails are direct-current machines supplied with energy through a motor-generator set. Electrical energy for this unique hoisting application is furnished by the East St. Louis & Suburban Railway Company.

THE ELECTRICAL EQUIPMENT OF THE TRAVELING SHOW.

The electrical equipment of the traveling show is one of cares of the inspector or city electrician of the community where the company is performing. How to treat stage wiring, which is in use only a few hours, but where any breakdown may be followed by the most disastrous consequences, is a question that constantly confronts the responsible inspector. Equipment which is approved in one city may be refused a permit in another. Improper repairs and additions may also be made from time to time. This subject was discussed at length at the recent convention of the Western Association of Electrical Inspectors at Milwaukee. Mr. B. W. Clark, chief inspector at Detroit, said that he requires a separate inspection of each show's equipment, for which a nominal charge of 75 cents is made. No equipment is permitted to be used until passed upon by the inspector. Such stage construction is treated as temporary work. Open-link fuses are permitted, for example, provided that the proper base material is used. Mr. Leon Taylor, Dallas, Tex., reported that each local stage electrician is placed under a $1,000 bond and a permit is required for each show. The inspections have been very rigid, recently the curtain being held for fifteen minutes on account of a broken condenser lens on a spot-lamp. Snap rings are required on all plug fixtures so that the parts cannot become accidentally disconnected. One man is required for each spot-lamp, and lamps operated from the audience must be roped off with a space 4 ft. around the stand and operator.

ELECTRIC MOTOR SERVICE IN A SMALL OKLAHOMA CITY.

In Mangum, Okla., with a population of less than 5000, the central station operates with an unusually large motor load, although the community possesses comparatively few manufacturing plants of a miscellaneous character.

The electric generating plant consists of two 200-kw units belted to simple non-condensing Corliss engines. There is a connected motor load of 455 hp made up of 150 hp driving three pumps which supply the city with water from three wells, 108 hp driving pumps and compressor for an ice plant (the ice plant using the condensed steam from the electric plant), 75 hp driving a cotton gin, 40 hp driving a cottonseed-oil mill, and 75 hp driving a laundry. Notwithstanding that the laundry has to have steam for drying and washing purposes, the electric service is very satisfactory. There are approximately 75 hp in planing mill, machine shop, bakery, two newspapers, ventilating fan in school building, blacksmith shops, harness shop and many other places where use in made of from 1 hp to 3 hp in motors.

A rather singular condition about the station load was that the peak of the year 1911 occurred during the day through the months of September and October, as the cotton business had been well started before the ice business had fallen off appreciably. The ginning of cotton by electric motor service has proved highly satisfactory.

Since December, 1910, when the plant was purchased by the present owners, the plant of the Magnum Electric Company has been entirely remodeled. The gross income has almost doubled within the past year, and with contracts which have already been signed the income for 1912 will exceed that of 1911 by 25 per cent. For the year 1911 the gross income per capita was $9.46. The city is lighted with sixty 6.6-amp series arc lamps. Mr. John C. Keys is president and Mr. E. W. McClintic is manager of the company.

THE ELECTRIC MOTOR IN A COFFIN FACTORY.

The Globe Casket Company, of Louisville, Ky., which was formed a short time ago, has installed the most approved types of mechanical equipment in its coffin factory, and every machine in the plant is equipped with an individual motor, electrical energy being supplied by the Louisville Lighting Company.

In making coffins many delicate carving and shaping tools are employed, and consequently perfect control and speed regulation of the carver must be given to the operator to produce the desired effect. By means of the range of speeds afforded and the readiness with which power may be entirely cut off the quality of work turned out is greatly enhanced.

Several molding machines are installed, all equipped with individual motors, the largest being a 15-hp, three-phase, 440-volt motor directly connected to a 10-in. molder. To operate the band-saws and rip-saws of the plant, tools which are employed constantly but which do not demand power of especial tension or regulation, a 15-hp motor drives two separate shafts. One of these shafts operates the rip-saws of the plant, while the other one operates the band-saws. In double-planing and edging the boards used in casket construction the Globe company uses a 30-in. double planer, which is one of the biggest machines of its kind in Louisville and has an unusually large capacity. The planer also is driven by a 20-hp motor, directly connected.

A feature of the plant's electrical equipment is the operation of a big blower by a motor. The blower is a 50-in. one, of the type usually found in wood-working plants, and is used to rid the establishment of sawdust, which may be utilized for fuel. It is operated at a speed of 850 r.p.m. by a 25-hp motor. Scraps and dust are used in heating the plant and in furnishing steam to the dry-kilns where lumber is dried to the desired stage before it is consumed.

COMPARATIVE FIRST AND OPERATING COSTS OF SHAFT, GROUP AND INDIVIDUAL DRIVE.

A shirt factory in a certain city was to be electrified, and methods of shaft, group and individual drive were considered. Approximately 150 machines were to be driven, and the question arose whether these could best be operated by two large motors with belts and shafts, by five group motors each driving a smaller number of machines, or by an individual motor for each machine. The total motor capacity was about the same for all three cases, but the friction load varied considerably, and so an investigation was made to compare friction losses with the increased first cost of individual motor drive. Reference to dealers' catalogues showed that the numerous small motors would cost from three to five times as much as the two larger motors to be used with shaft drive. The yearly cost of maintenance was also higher, and the figures obtained for annual energy consumption, cost of energy and total annual cost are given in the accompanying table, which classifies the three forms of drive.

COMPARATIVE INVESTMENT AND OPERATING COST, INDIVIDUAL AND GROUP DRIVE, FOR SHIRT FACTORY.

	Shaft.	Group.	Individual.
Number of machines	174	149	149
Number of motors	2	5	149
Aggregate capacity, motors, hp.	28	25	24-5-6
Friction load, kw.	9.7	5	2.5
Initial cost	$1,000	$1,400	$4,500
Yearly cost, maintenance	$30	$50	$125
Fixed charges	$150	$210	$175
Annual kw-hr. consumption	42,630	24,240	22,700
Cost of energy at 4 cents per kw-hr	$1,704	$969.60	$908
Total annual cost	$1,884	$1,229.60	$1,708

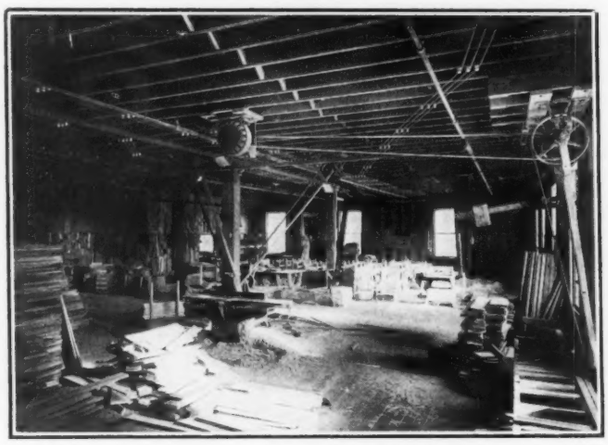
From the above figures it will be seen that the five-motor group will be most economical with energy at 4 cents. On the other hand, the two-motor group will effect a saving over the individual drive as long as energy is less than 3.3 cents per kw-hour; also a saving over the five-motor group for energy costing less than 0.6 cent per kw-hour.

BY-PRODUCT ICE FROM NEW TURBINE STATION AT LEXINGTON, KY.

A 75-ton absorption-type ice-making plant is being installed in the new turbine station of the Lexington (Ky.) Utilities Company, a preliminary description of the steam features of which was given in these columns on Dec. 2. Utilization of the exhaust from a 25-kw pump turbine, location of refrigerating equipment and freezing tanks in buildings 500 ft. apart, and the use of cooling water at initial temperatures of 90 deg. to 95 deg. Fahr. are among the unusual features of this new installation. A turbine driving one of the circulating-water pumps will furnish steam at 25 lb. back pressure for the operation of the absorption generator, which will be mounted on a platform in the new plant building, saving extra floor space. Exhausting into the atmosphere this turbine would take 50 lb. of steam per kw-hr., while at 25 lb. back pressure its consumption is increased only to 70 lb., resulting in a difference of about 20 lb. per hp-hr., chargeable to ice manufacture. This is believed to represent a consumption of about one-third the quantity of steam that would be required by a compound condensing compressor plant. During the summertime the temperature of the cooling pond from which the condenser supply is taken rises to 95 deg. Fahr., and the increment through which the circulating water for the refrigerating plant is heated will amount to only a few degrees. The condensate from the two main 2500-kw plant turbines will be used as material for making the ice, supplying distilled water pure and entirely free from oil. Messrs. Sargent & Lundy, Chicago, are consulting engineers for the new Lexington station, the absorption-type ice-making machinery for which is being furnished by the Carbondale Machine Company, Carbondale, Pa.

MOTOR DRIVE IN A WOOD MILL.

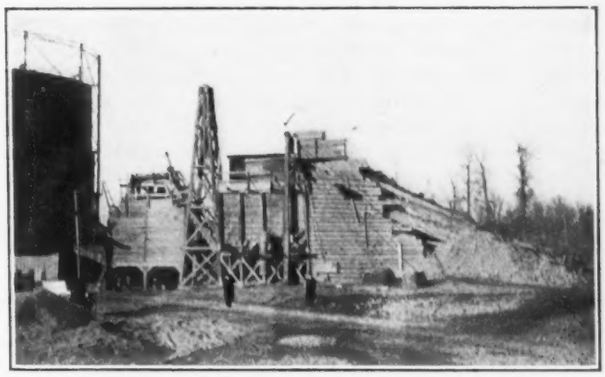
The Fort Smith (Ark.) Crutch & Bed Company has converted its wood mill to motor drive, making use of modern construction for wiring and distribution, overhead motors, etc., as shown in the accompanying illustration. Two-phase, 220-volt, 60-cycle energy from the lines of the Fort Smith Light & Traction Company is employed to operate the wood shop. A 7.5-hp motor, running at 1800 r.p.m., drives the double-end cut-off saw. A 5-hp motor, running at the same speed, is belted to the 24-in. planer. Individual motors of similar type drive the trimming saw, the 16-in. hand jointer and the swing cut-off saw. The cut-out cabinets for the motor circuits are grouped on the wall seen at the far end in the picture.



Wood Mill Equipped with Motor Drive

CONTRACTOR'S MOTOR-DRIVEN GRAVEL HOIST AND CRUSHER.

The Carson Mathews Company, of Eugene, Ore., makes use of a motor-driven sand and gravel hoist and crusher, the total connected load of which is 140 hp. As shown in the accompanying illustration, a 100-hp, 2300-volt alternating-current motor drives the main hoist. The smaller



Sand and Gravel Hoist and Crusher.

induction motors are of the 220-volt type. A 25-hp motor is belted to the crusher and a 15-hp unit is belted to the sieve and conveyer. The Mathews plant operates with a load-factor of about 7 per cent, the average monthly kw-hour consumption during eight months being 5800 units. Per horse-power installed the average cost of operation has been $1.19 per month. On account of the greater activity in the building trades during the summer months, such a gravel and sand plant as that illustrated has a characteristic summer load curve very beneficial to the central station with an industrial-motor load. Following is given the monthly consumption of energy of the Eugene hoisting plant: April, 4940 kw-hours; May, 1590 kw-hours; June, 4210 kw-hours; July, 7600 kw-hours; August, 6650 kw-hours; September, 8180 kw-hours; October, 7170 kw-hours; November, 5900 kw-hours.

FREE ENERGY FOR PIPE THAWING AT ROCHESTER, N. Y.

During the present winter the number of cases of frozen water pipes in Rochester, N. Y., has been so great that the Rochester Railway & Light Company has found it expedient to place at the disposal of the water department of the city six gangs of four men each who receive orders from the water department and work in conjunction with men familiar with the water piping of the city. All cases brought to the attention of the lighting company are referred to the water department for relief, and the company receives from the water department compensation for the actual time of its men placed at the disposal of the department and for the material used. The energy used in thawing out the frozen water pipes is given free of charge. Naturally the lighting company has been somewhat handicapped all winter by the absence of its twenty-four employees, but enthusiasm for the welfare of Rochester and its inhabitants makes the inconvenience of little effect.

In the direct-current districts a special clamp is fastened to the frozen hydrant and one side of the system is connected to the clamp through a switch by means of a coil of wire having sufficient resistance to protect the system against a short-circuit. It is usual to fuse the switch for 1000 amp and if the fuse blows to substitute a coil of smaller wire, the wire sizes carried by the crew ranging from No. 6 to No. 0000. The direct-current system having a grounded neutral, no other connection is of course necessary, and the time required to thaw a pipe after this fashion ranges from two to four minutes.

In the alternating-current districts the automobile is

Pipe-Thawing Outfit at Rochester, N. Y.

equipped with two transformers connected in series on the 2300-volt side and in multiple on the low-tension side. Connection is made to the nearest lines by means of a coil of wire which, with the resistance of the pipe, will limit the current to from 200 amp to 300 amp. The switch is left closed until the pipe is freed. If the water pipe is of small diameter and very long the full voltage of the alternating-current system is applied for a few minutes.

MODEL OF ELECTRICALLY DRIVEN SHOP AT PROVIDENCE.

The Narragansett Electric Lighting Company, of Providence, R. I., has recently placed on exhibition at its offices a model electrically driven machine shop for the pur-

Model of Motor-Driven Shop.

pose of advertising its electric-motor-service facilities. The model is 6 ft. long by 3 ft. high, and consists of a miniature two-story factory with pattern shop, machine shop, electric elevator, office and drafting-room complete in

every detail from workbenches and anti-spitting signs to tiny electric lights and office fittings. Each floor is equipped with a group of tools of German make driven by a motor mounted on the ceiling, about twenty tools being in use. The exhibit is 20 in. deep, and emphasizes the fact that over 18,000 hp in motors is now in service on the company's system, an engineering department being maintained by the company for the benefit of its customers. Motor lay-outs, specifications and estimates are furnished and electric and steam test are made without charge. The exhibit has attracted much attention in Providence, and is being utilized in connection with various industrial displays outside the office as well as within the regular new-appliance exhibition room.

DELIVERY COSTS WITH ELECTRIC TRUCKS.

A large Cleveland department store has eight Baker electric delivery wagons in service, making its package deliveries over a large area of the city's paved and unpaved street. During a normal month like November last 164 packages were delivered daily at an average cost per package of 4.03 cents, including all operating expenses, depreciation, insurance, interest on investment, etc. During the holiday rush that occurred in December 247 deliveries were made daily, the actual cost for each package delivered being

ELECTRIC-TRUCK PERFORMANCE.

Date.	Mileage.	Number Packages.	Date.	Mileage.	Number Packages.
Nov. 1	34	169	Dec. 1	33	164
2	37	172	2	40	170
3	35	153	3	47	183
4	31	170	4	42	142
6	45	145	5	50	195
7	27	208	7	34	208
8	52	142	8	27	227
9	33	167	9	30	240
10	41	130	10	41	243
11	56	123	11	33	198
13	34	175	12	38	204
14	43	150	13	30	260
15	30	213	15	27	314
16	22	230	16	32	348
17	32	214	17	44	264
18	46	174	19	25	309
20	34	145	20	26	332
21	37	143	21	32	280
22	35	210	22	40	196
23	40	121	23	21	263
24	37	135	24	34	401
25	34	163	27	42	307
27	32	112	28	45	277
28	30	174	29	43	209
29	26	150	30	24	179
			31	26	147

but 2.7 cents. In each instance the total daily travel of the wagons was about the same, 35 to 36 miles per wagon per day. The accompanying table shows the average performance of the eight trucks for each day in November and December.

INCREASING USE OF ELECTRICAL ENERGY FOR ICE MAKING IN CHICAGO.

It is estimated that 2,000,000 tons of ice are used annually in Chicago. As it takes from 50 kw-hr. to 55 kw-hr. of electrical energy to manufacture a ton of artificial ice a ready statistician has computed that if all the ice were made in electrically operated plants it would require 110,000,000 kw-hr. per annum, which would be a considerable addition to the load on the central-station system.

While it may be doubted whether this consummation will ever be reached, a good start has been made in the direction indicated. Representatives of the contract department of the Commonwealth Edison Company make an argument for the manufacture of artificial ice by central-station electrical energy which has convinced several of the ice manufacturers. The greatest expense in handling ice is caused by transporting the product to the premises of consumers. It is thought not to be economical to haul ice for a radius greater than 1 mile from the icehouse or manufacturing plant. Therefore, it seems to be logical in a large city to establish a number of small ice-making plants scattered throughout the wide area served, in order to reduce the big item of expense—that is, haulage—to a minimum. The use of electrical energy from a central station lends itself admirably to this plan of having scattered centers of production. Furthermore, it is not necessary where ice is made by purchased electrical energy to maintain a large warehouse with the consequent expense for real estate.

On the part of the central station the ice-making and refrigerating plants form a desirable summer load, and by making an arrangement, as is done in Chicago, whereby the ice-making plants can be off the peak in the winter months an especially low rate can be made by the central-station company. In the contract for this "off-peak" rate it is provided that electricity shall not be used between the hours of 4 and 8 p. m. during the months of November, December, January and February.

At present the Commonwealth Edison Company is supplying electricity for ice making to seven plants. Three of these belong to the Knickerbocker Ice Company, one being located at 1701 West Van Buren Street, another at 6105 Lexington Avenue and a third at 638 West Sixty-fifth Street. The Lincoln Ice Company has an electrically operated plant at 325 North Elizabeth Street, the Crystal Ice Company one at 1457 Clybourn Avenue, Anderson & Goodman one at 4237 South State Street and the Englewood Distilled Water Ice Company one at West Sixtieth Street and Armour Avenue. It is also worthy of remark that the Knickerbocker Ice Company is building two more plants and Anderson & Goodman one more plant, after one year's satisfactory experience.

All the ice-making plants in operation by central-station energy use two compressors each, except in the case of the Crystal Ice Company and the Englewood company, each of which has one compressor. The total connected horsepower varies from 235 hp in the case of the Crystal Ice Company to 564 hp in the case of the Lexington Avenue plant of the Knickerbocker company. The rating of the plants varies from 60 tons of ice a day in the case of the Crystal Ice Company to 180 tons in the case of the Lincoln Ice Company.

SOLICITING MOTOR BUSINESS IN A CITY OF 20,000.

The central-station manager in the small city who starts out to make special rates to secure motor business should first become thoroughly conversant with the relation of load-factor to the cost of energy production. For, as pointed out by Mr. A. E. Peirce, Jr., assistant manager of the Chippewa Valley Railway, Light & Power Company, before the Wisconsin convention at Milwaukee, Jan. 18, it is sometimes necessary to offer rates lower than the present cost of manufacturing energy where the power load has not been developed. Knowledge of the possible and probable additional load will enable the manager to make a rate that will get this business in such amount as to reduce the cost of manufacture to a profitable point in relation to the new power rate, incidentally giving an increased profit on the load already carried.

In the city of 20,000 under consideration every possible power consumer should be classified and listed. Many loads may be tabulated that will seem hard to connect up, but

after a year or two it will be surprising to look back and see how many of the hard customers have been secured. The solicitor is advised, therefore, to open a file for every power user and to begin to collect data pertaining to each. At the same time he should get on friendly terms with plant managers, and if convenient take them through electrically operated shops in similar lines.

The Chippewa Valley company has made a practice of drawing up floor plans of the premises of power users, locating thereon each machine with its description. The engine is then tested, cards being taken throughout an entire day. During the noon hour the friction load of the shafts and belts is measured, and then the friction of the engine itself. All information possible is obtained from the engineer and fireman regarding quantity of fuel used, oil, etc. The shop layout is then gone over carefully to decide where group and where individual drive is best, whether the motors should be located on wall, floor or ceiling, the size and speed of motors, and whether these should be directly connected or belted. In this respect the motor manufacturers can help, as they have experts, familiar with different classes of work, who will gladly lay out the proper drives in case the central-station man is not familiar with the particular power requirements. Figures are obtained next on the wiring, the motors, etc. A sheet is then drawn up, showing the probable cost of electric drive, interest and depreciation on the electrical installation, etc. Against this is balanced the present cost of isolated-plant power. This completed plan is then submitted to the manager. Usually it can be shown that an increase of 10 to 20 per cent in output can be effected through electric drive, without other change in machines or men. Individual operation is also found to save the enormous friction losses of belts and shafting, which in many plants reach values of 40 per cent of the total load.

CENTRAL-STATION DRIVE OF OIL WELLS IN CALIFORNIA.

The operation of oil-well pumps by central-station energy has generally been considered outside of the possibilities of motor drive in most large oil fields on account of the cheap fuel available at the wells. Most oil wells produce more or less natural gas, and, as this has to be wasted in any event, the common practice has been to install gas or steam engines to work the pumps. Near Folsom, W. Va., a number of motor-driven oil wells have been in operation several years. Recently central-station service has been introduced among the wells of the Kern River and Los Angeles fields in California, where more than 300 motors are now at work, resulting in a saving of half the former cost of steam drive. Back-geared, star-delta, variable-speed motors are used, these motors being arranged with switches to convert their windings from star to delta connection. In star the motors develop 10 hp continuously. Delta-connected they develop 30 hp and momentary overloads as high as 75 hp. Pumping and pulling is done on the low-power connection. When cleaning the well the high power is required to hoist the bailer and to spud it with the sand reel. For spudding from the wrist pin only the low power is required. The motor speed is governed by a street-car-type controller operated through lever and wire transmission. The wells average 850 ft. in depth and require 100 kw-hr. to 180 kw-hr. for cleaning. At 1.2 cents per kw-hr. this makes the cost of cleaning $1.20 to $2.16. The principal saving in cost of oil-well operation by motor is due to lack of standby losses and to good efficiency at low speeds, starting and overloads. Steam losses due to condensation during rain and snow are saved with the electric motor. Electricity is more flexible and easy to transmit than steam, responds more quickly, breaks fewer rods, does not run away when a rod is broken, and is more quickly reversed. In comparing costs of steam and electric drive the *Journal of Electricity, Power and Gas* submits the accompanying figures and makes the following comments:

COSTS PER WELL PER DAY.

	Steam.	Electricity.
Labor, operating (oilers, well gang, boilermen and electricians)	$0.60	$0.40
Maintenance (fuel, water, oil and electric power)..	2.55	1.35
	$3.15	$1.75

Saving electricity over steam, $1.40 per well per day.
Reduction in operating expense, 44.5 per cent.
(In the above, fuel oil is taken at 40 cents per barrel).

"On the basis of 233 wells, this means a saving in operating expense of $119,000 per year.

"The market price of oil in the Kern River fields to-day is about 32 cents per barrel at the well. From the figures given it is obviously out of the question to pump wells by steam when the production falls below 10 bbl. per day. In the case of electricity the production can fall as low as 5½ bbl. per day before the cost equals the selling price of the product. In the Eastern fields, where the oil is of a paraffine base, wells are actually pumped by electricity which produce only 2 bbl. and 3 bbl. per day.

"The cost of electrification varies from $675 to $900 per well, depending on type and size of motor, method of installation, transmission line and transformer layout. Assuming $750 as the cost, with a saving of $1.40 per well per day, the electrical installation would pay for itself in 535 days, or eighteen months not counting Sundays. In three years it would pay for itself and the full service value of the steam system. After three years the saving of $1.40 per well per day would be clear profit. Instead of setting aside the total saving effected by electricity, a sinking fund of 25 cents per day at 6 per cent interest will pay off $750 in seven years."

EMERGENCY PREPARATIONS TO MEET 2000 PIPE-THAWING CALLS IN CHICAGO.

The extraordinary cold spell which gripped Chicago after the first of January was followed, at a time-lag of several weeks, by numerous cases of frozen water pipes and mains as the low temperature penetrated to the pipe levels. The Commonwealth Edison Company has done little pipe-thawing service in recent years, but this season, at the solicitation of the city water works department and of citizens, it undertook to render such service at the cost of time and labor, as an accommodation to the public. The first requests were received the latter part of January, and by Feb. 1 113 services had been thawed for the city and forty for private parties. Where the householder reported the trouble through the water department the city paid for the work of thawing, although a number of water users applied directly to the Edison company, preferring to incur a slight expense in the hope of getting more prompt attention. All work was attended to with the maximum dispatch, but the number of calls rapidly outdistanced the available force for the work, although pipe-thawing equipment and crews were assembled from all departments. On Feb. 19, for example, 350 calls were received in a single day, bringing the total number to that date above 2000.

To meet these 2000 calls for assistance, the majority received within twenty days, all the company's regular line wagons and trucks that could be spared were equipped with pipe-thawing transformers, extra wagons were borrowed from other departments, and all regular construction and repair work, except of an emergency nature, was inter-

rupted to man the pipe-thawing crews. Eighteen fully equipped outfits were thus assembled and put into service during the worst days, each gang thawing seven to eight services per day. Each crew comprised a driver, the foreman, one or two linemen, and a plumber, the latter employed by the city or the householder.

A pair of 10-kw or 15-kw distributing transformers with their primaries arranged to be connected in series across the nearest 2200-volt circuit, and delivering 50 volts at their secondaries, formed the electrical equipment of each wagon. No current-regulating protective or measuring devices other than the primary fuses were used, although it was first planned to equip the crews with ammeters, reactance coils, etc., only a few of which were available.

On reaching the location of the frozen water pipe, the linemen prepared to make connection to the transformers from the nearest 2200-volt line, while the plumber entered the cellar and disconnected the house piping from the street-service line. This precaution was insisted on since fires have occurred where the heavy thawing current could find some other outlet than the intended path through the service pipe. One 50-volt secondary lead was then run to

Pipe-Thawing Outfit at Chicago.

the cellar end of the service pipe and the other attached to the nearest fire-plug or hydrant. Through the path thus formed, having a resistance of a fraction of an ohm, currents of 200 amp to 300 amp were delivered by the 50-volt pressure, and this was found to thaw the average service in from five to fifteen minutes. In the case of longer or higher resistance paths, the time required for thawing with 50 volts was simply a little longer, and regulating apparatus was not found necessary. The crews without ammeters, once familiar with their work, handled the jobs as easily as those fitted out with indicating devices. The first wagons equipped exhausted the supply of 10-kw and 15-kw transformers, and the later crews were provided with 20-kw and 25-kw transformers having their primaries connected in series at the connection blocks. No attempt was made to meter the energy used, as this probably amounted to only from 2 kw-hr. to 4 kw-hr. per job and was considered negligible. In one case where a 6-in. street main was frozen, shutting off all the water in its block, the application of 75 kw at 100 volts during an hour was required.

The labor and material used at each job were figured at cost in billing the householder, the average cost per job being only $10 to $13. This amount is, of course, negligible compared with the cost, time and trouble of freeing the pipes by digging them up. Such a remedy also leaves the pipes in even more vulnerable condition than before, as the frozen dirt cannot be packed back properly and is penetrated rapidly by surface frost, resulting in repeated trouble. This was demonstrated in the case of the large street main above referred to, where the main paralleled a trench which had been backfilled during the present season of frost.

The freezing of water pipes has its psychological side. Sunday, Feb. 18, the weather turned quite warm in Chicago, the thermometer rising to 50 deg. beneath a bright sky. The next day the Commonwealth Edison Company received 350 appeals to thaw frozen pipes, the greatest number in one day during the 1912 cold snap. Good householders who had been keeping their spigots open during the extremely cold weather concluded that their troubles from freezing were at an end with the first warm day and allowed the circulation to be shut off, forgetting that at the depth of the pipes the ground was still as cold as ever. In all more than 1000 services were thawed out by the Commonwealth Edison Company during the period above noted, for which disinterested service it earned the thanks of numerous householders and the Chicago public at large.

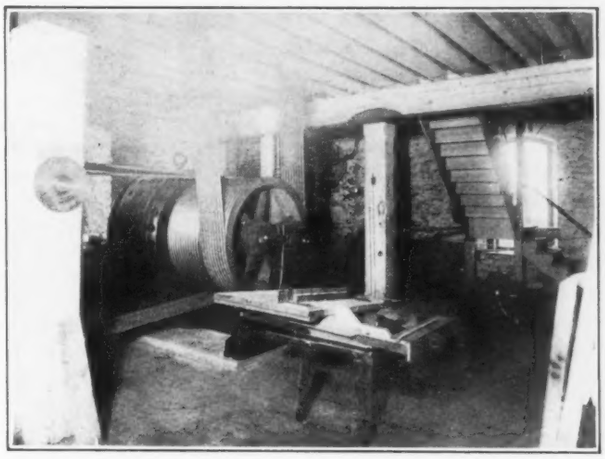
CONVENIENT NEWS BULLETINS.

One of the time-saving innovations introduced by President Einstein of the Union Electric Light & Power Company, of St. Louis, is a circular news-bulletin service. All the St. Louis daily newspapers are read carefully in the president's office, and everything judged to be of interest to heads of departments, whether relating directly to the company or not, is cut out and pasted on a sheet of cardboard 14 in. wide and 18 in. long. This bulletin is then passed in succession to the sales manager, the manager of the automobile department, the secretary, the chief electrical engineer, the chief engineer of power plants and the purchasing agent, and then returned to the president's office for filing. Each department head indicates the time the sheet is received and adds his initials on a printed form in one corner of the bulletin. This system does away with the reading of the newspapers for information, prospects, etc., in each department; one reading does for all departments. However, any officer noticing any news of interest is expected to transmit it to the president's office for the bulletin service, lest it be overlooked. The bulletin serves the further purpose of being the medium of company orders and announcements. The signing of the blank shows that all the information given on the sheet has been conveyed to each department.

FAMOUS QUEEN BEE MILL NOW ELECTRICALLY DRIVEN AFTER THIRTY-THREE YEARS' IDLENESS.

In 1879 the famous Queen Bee flour mill was built at Sioux Falls, S. D., at a cost of half a million dollars. At that time, recognized as the finest mill of its kind in the world, it attracted many foreign visitors, several of whom, during its construction, came from as far as Budapest, Hungary. The walls of the structure, 80 ft. by 100 ft. and seven stories high, are of Sioux Falls jasper granite, an extremely hard stone which makes the best cobble paving for heavy traffic. The mill was operated for a year, but was shut down in 1880 because both the railroads entering Sioux Falls had their Western termini there, and all grain had to be hauled from the East and the flour shipped back.

Since that time the old mill stood idle until the present year, when it was re-equipped for electric drive at greatly increased production. The building itself was in splendid repair and only the roof needed re-covering. The old combination of millstones and rolls was replaced by modern Allis rolls, and the stones were discarded. No sifters or differential reels were included in the first equipment, but during the rehabilitation a modern line of Nordyke & Marmon machines was installed. The purifiers, dust collectors and flour packers were also rebuilt and the shafting was rearranged.



350-hp Induction Motor in Queen Bee Mill, Sioux Falls, S. D.

The principal motor, a 350-hp Westinghouse slip-ring, induction-type machine, is shown in the accompanying illustration. Running at 315 r.p.m., it operates, through a three-bearing rope drive and 2400 ft. of 1¼-in. manila rope, the following machines: Fifty-one pairs of Allis rolls, 9 by 24 in., 9 by 30 in., and 9 by 42 in.; fifteen standard Smith purifiers; four large sifters and forty reels and carriers, 32 in. in diameter by 9 ft. and 16 ft. One 50-hp motor drives the wheat-cleaning machinery, and another similar unit operates the grain elevator and flour cleaners in the elevators. A 35-hp motor operates the flour packers.

The former capacity of the Queen Bee mill as arranged for 800-hp waterwheel drive was 800 barrels of flour per day. Now, using a total of only 485 hp in motors, its capacity has been increased to 1200 barrels.

Switches are scattered through the mill so that the motors can be stopped from any position in case of emergency. Throughout the installation all wiring has been done with three-conductor, rubber-insulated, lead-covered cable, and all motors and switchboards are inclosed in terra-cotta-lined fireproof rooms. The Queen Bee mill obtains its energy from the lines of the Sioux Falls Light & Power Company.

A MOVABLE MOTOR ON A DAKOTA FARM.

All of the ordinary farming operations at Bacon's farm near Grand Forks, N. D., are now performed by electrical energy supplied from the lines of the Red River Power Company, of Grand Forks. A gasoline engine used to be the prime mover on the Bacon place, but since the coming of electric service the gas engine stands no chance of returning. Its successor is a three-phase alternating-current motor which is mounted on a portable truck and can be conveyed around the place to any point where there is work to be done. As shown in an accompanying illustration (Fig. 2) the motor is well housed, its shed on wheels containing also the starter, fuses, etc. This picture shows the motor driving a corn cutter. Close to the ground can be seen the driving belt, which enters the shed through a rear opening. The movable shed is carried on an ordinary farm-wagon body and can be blocked fast wherever it is desired to set up the plant. Energy for the motor is supplied through a number of three-pole contact blocks mounted on the farm buildings. As illustrated in Fig. 3 these contact boxes include the features of both fuses and switch, the block shown being engaged by the clamp pieces for the inclosed fuses. The housing protects the charged parts from the weather. Fig. 1 shows a corn shredder being operated by the motor through the means of the long belt which can be seen close to the ground behind the team of mules. The same picture also shows the three-phase service wires entering the barn at the left, from which the farm motor gets its energy supply.

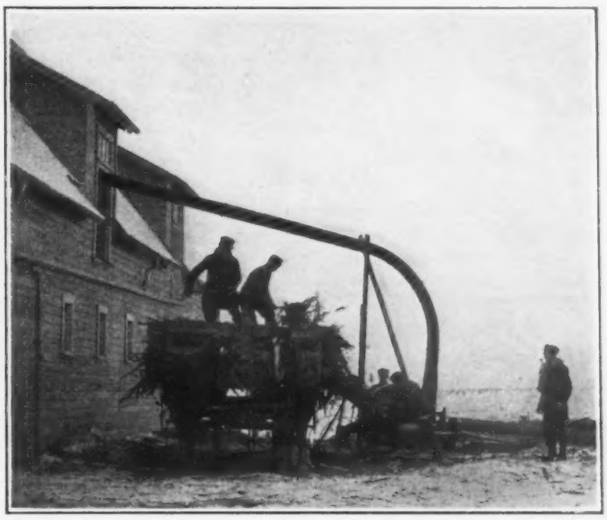
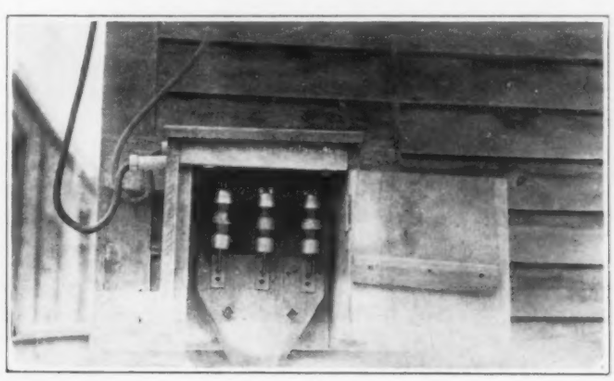


Fig. 1—Motor Driving Corn Shredder.



Figs. 2 and 3—Portable-Motor Shed and Outlet Box for Farm Motor.

Wiring and Illumination.

PROPOSED CITY ORDINANCE GOVERNING WORK ON HIGH-TENSION CONDUCTORS.

Following the death of several linemen recently while working on the high-tension and primary distributing lines in Minneapolis, an ordinance is now before the City Council requiring all such equipment in customers' premises to be rendered "dead" before being approached by workmen and also stipulating that all poles carrying conductors of a potential above 650 volts shall be conspicuously marked by a bright red band painted just below the cross-arms.

The proposed ordinance, which amends the present electrical ordinance, is understood to have the approval of the central-station company, the local city inspection department and the state labor commissioner. The last-named official is preparing to issue a general order requiring similar conditions for the safety of workmen about high-tension conductors.

Under the provision of the new ordinance, where buildings are served with high-potential energy the service wires must be so arranged that they may be completely disconnected at the pole outside, using an approved pole-switch or cut-out. The new ordinance will also make it unlawful for any person to make or attempt to make changes in such high-potential wiring or apparatus without first opening the pole cut-out. Companies having line-construction gangs are required to post conspicuously about the places where such employees assemble warnings of the dangers of working on or near high-potential conductors and instructions for the use of safety devices. Foremen must frequently demonstrate the use of such safety devices and require their men to use these devices where advisable and to remain out of positions of danger.

The final clause of the amendment requires that all poles carrying wires above 650 volts must be designated by a band of bright red paint, applied 3.5 ft. below the lowest cross-arm, this band to be 4 in. wide and kept in a readily discernible condition, being repainted at least once a year.

FUSING OF INDUCTION-MOTOR CIRCUITS.

It appears from a bulletin recently issued by the Canadian Fire Underwriters' Association that definite action has been taken by that body with reference to the fusing of induction-motor circuits, concerning which the National Electrical Code is more or less indefinite.

Induction motors rated at 5 hp and less may be started without compensating devices, according to the rules, but they must have two sets of fuses on all sizes above and including 5 hp. The practice of throwing these motors on the line and depending on one set of fuses is not approved in Canada, and is classed as a defective installation. Owing to the abnormal current required in starting it is necessary to have fuses which will pass more than the rated full-load current of the motor, so that unless the circuit is protected with a double set of fuses there is practically no protection to the motor when it is operating under normal running conditions.

Induction-motor circuits must be provided with an approved double-throw switch, and where the mains are already properly fused the starting side can be connected direct to the circuit, but the running side must be fused to protect the motor. Approved cut-outs fitted with proper fuses of the same current-carrying capacity in each phase are specified. The Underwriters draw attention to the fact that the practice of replacing blown fuses with copper wire is much more dangerous than is generally realized by motor users and should not be permitted. It is not only a dangerous practice but it renders the motor liable to destruction as well.

Circuits for induction motors must be large enough to carry the starting current, but for starting current only may be rated according to the allowable current-carrying capacity of wires possessing other than rubber insulation, as given in Table B of the National Electrical Code, though the wire itself must be rubber-covered. The motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated, but where the wires under this rule would be overfused in order to provide for the starting current, as in the case of many alternating-current motors, the wires must be of such size as to be protected properly by the larger fuses. The double-throw switches required on induction-motor circuits must in all cases be plainly marked, showing in large plain type "starting" and "running" side.

Oil-immersed ironclad auto-starters are recommended for motors above 7½-hp rating. In dusty places and in the neighborhood of inflammable material auto-starters with exposed switch blades are not approved. Motors started by such devices may, where the mains are already properly protected, be connected directly to the mains on the starting side, but must be fused to protect the motor under normal operating conditions on the running side.

The Underwriters draw attention to the fact that in laying out the wiring for induction motors it is advisable to provide ample copper and to keep the system of mains large and solid, so as to avoid a multiplicity of fuses, which would be required if branch circuits are of small current-carrying capacity. Double-throw switches with fuses are strongly recommended, and in some locations may be required on motors under 5 hp in rating. The double-throw switch must be so constructed that it cannot be left on the starting position.

SCREWS OR NAILS WITH SPLIT KNOBS?

The use of nails with leather heads was originally permitted with split porcelain knobs and cleats. The code for 1909, however, prohibited the use of such nails, requiring screws for putting up knobs. Later this prohibitory clause was in turn repealed at the earnest request of many complainants, and at the present time the use of nails with leather washers is again authorized by the code.

This subject of the use of nails or screws with knobs and cleats occasioned some interesting discussion at the meeting of the Western Association of Electrical Inspectors at Milwaukee on Jan. 25. Mr. R. J. Swain, city electrician, St. Boniface, Manitoba, pointed out that nails hold better than screws in certain woods. Mr. G. W. See, Minneapolis, said that the breaking of knobs at the time of putting them up is not the only source of trouble, for the binding tension applied sometimes acts to crack the knob some little time after it has been put in place. It is common, he said, to complete an installation and half an hour later hear a loud crack caused by the shattering of a knob driven fast under too much pressure. Mr. H. B. Long, Nashville, Tenn., declared that it is the practice of many wiremen in putting up knobs with screws to drive the screws in nearly all the way, giving them only a couple of turns with a screwdriver to tighten them. Mr. Aldrich, Chicago, said that the principal argument in favor of the nail is the great saving of the wireman's time compared with putting in screws. Nails are also slightly cheaper than screws. The insulating value of either construction is practically the same. Other speakers testified that screws do not hold so well as nails. On motion of Mr. James Bennett, Montreal, the inspectors present voted, sixteen to twelve, asking the code committee of the association to recommend alterations in the present rules so that the use of leather-headed nails with split knobs and cleats shall be entirely prohibited.

SAFE PULLING-IN STRESSES FOR CABLES.

Attention was drawn to the limiting safe tension which may be applied to power cables in the process of drawing them into underground ducts at the Milwaukee convention of the Western Association of Electrical Inspectors, on Jan. 23, by Mr. Hugh T. Wreaks, New York, chairman of the committee on underground systems. The speaker pointed out that if this safe limit be exceeded the distortion set up in the members of the cable may impair its insulating and dielectric strengths below the values previously tested under unstrained conditions. While Mr. Wreaks had not had an opportunity to test various sizes of cables under actual tensional stresses, he presented before the convention a rough estimate of the safe pulling stresses for three-conductor cables ranging from No. 10 to No. 0000 in size, based on a safe elastic limit for copper of 10,000 lb. per square inch. As lead has a unit strength of only 300 lb. per square inch, the presence of the sheath was neglected.

SAFE WORKING STRENGTHS.

Cable Size.	Copper, Three-Conductor.	Paper, 1000 lb.	Paper, 5000 lb.
No. 10	240	337	1685
No. 8	390	337	1885
No. 6	630	437	2185
No. 5	780	469	2345
No. 4	990	504	2520
No. 3	1230	546	2830
No. 2	1560	591	2955
No. 1	1950	645	3225
No. 0	2490	694	3470
No. 00	3120	762	3810
No. 000	3960	835	4170
No. 0000	4980	918	4590

The cables calculated had a 3/32-in. layer of paper around each of the three conductors, with another 3/32-in. layer inclosing the whole. The strength of this paper in the cable Mr. Wreaks considered problematical. Braid has a strength of about 5000 lb. per square inch, and the paper covering might be assumed to be equally strong. On the other hand, computing the strength of the paper as purely frictional, 1000 lb. per square inch might be taken. The accompanying table shows the limiting strengths to be expected from various sizes of cable, the columns showing the safe working limits of the copper and paper, in which the latter is figured at both 5000 lb. and 1000 lb. per square inch.

MOTOR OPERATION OF MOVING-PICTURE MACHINES.

Moving-picture machines driven by electric motors are expressly forbidden under the wiring code, the purpose of this restriction being to necessitate the entire attention of the operator being given to his machine. Several bad fires have been caused by motor-driven machines, owing to belts coming off and stopping the film in front of the intense rays of the lamp. Other fires have been traced to smoking by the operator, which would not have been likely to happen had he been required to crank the machine. The Western Association of Electrical Inspectors discussed this subject at Milwaukee on Jan. 25, Mr. James Bennett, of Montreal, Canada, declaring that an exception should be made to the rule in the case of the new motor-driven kinemacolor machine, the joint invention of an American and an Englishman for projecting pictures in natural colors and motion. This machine is much larger and heavier than the usual projector outfit, and actually requires a motor to drive its heavy parts, which move at a speed twice the ordinary rate. The services of two men are also demanded to operate the machine, and the current taken by the arc ranges from 80 amp to 125 amp. The kinemocolor apparatus is thus totally different from any of the ordinary picture machines, and in its design all possible precautions have been taken against fire communicating to the film, including the provision of an auxiliary automatic shutter outside the condenser. Mr. Bennett urged that this machine should have official approval for motor drive. Mr. F. L. Daniels, Indianapolis, told of a new safety device which, he believes, will make motor-driven operation safe. A switch controlling the lamp circuit is so arranged that the breakage or stopping of the motor belt will instantly extinguish the arc. Mr. Leon Taylor, Dallas, Tex., insisted that an even greater danger lies in the hand-feed type of arc than in motor drive. He cited a case in Dallas where an operator "froze" the carbons of one lamp and then attempted to operate a second. The excessive current thus taken overheated and burned out the conduit wiring, ignited several thousand feet of film and caused $2,000 loss. Mr. H. E. Bloomer, Milwaukee, reported that of the sixty-one moving-picture machines in his city eight are motor-driven and have given practically no trouble. Seventeen fires have occurred, all among the hand-operated machines and usually due to ignition of the film while outside the machine. Mr. W. S. Boyd, Chicago, said that without experience one can hardly realize the tremendous explosive energy of the standard 1000 ft. of film, and he doubted the advisability of leaving to the inspector's judgment the approval of such machines. A special committee was appointed to examine the apparatus mentioned by Mr. Bennett and to report on its safety with motor drive.

EFFECTIVE ILLUMINATION SCHEME OF HOLY TRINITY CHURCH, NEW YORK.

Roman Catholic Edifice Illuminated from Concealed Light Sources Located 30 Ft. Above Field of Illumination and Aggregating Less than 10 per Cent of Its Marginal Length

Artificial illumination throughout the eras of tallow, oil and gas was of necessity restricted to chandeliers and brackets; but after the advent of electricity the possibility of eliminating the often more or less cumbersome fixtures was quickly realized, and the efforts to minimize their obtrusiveness soon brought forth the method commonly known as concealed lighting. The earliest attempts at the latter form of lighting relied solely upon the plaster and paint for reflection and diffusion, while the more modern methods employ reflectors of metal and glass placed as much out of sight as possible. A new Roman Catholic church, Holy Trinity, has just been completed on West Eighty-second Street, New York, and will shortly be dedicated by Cardinal Farley. The edifice is patterned somewhat after the Mosque of Santa Sophia at Constantinople, and both the architect and the consulting engineer have combined originality of conception and courage of exetion by illuminating an area 60 ft. square from concealed light sources located 30 ft. above the field of illumination and aggregating less than 10 per cent of its marginal length on a power consumption of 2880 watts.

The design of the church is modified Byzantine and the interior walls are finished with a warm-toned, golden-brown face brick. The columns and frieze are of slightly cool-hued buff terra-cotta with light-green panels; the domes and penetrations are of Guastavino tiles harmonizing with both brick and terra-cotta, and the pews, confessionals and gallery railings are of dark-brown oak. So softly do the tints of these various fabrics blend that the effect would be almost monochromatic were it not for the contrasts afforded by the light-colored marbles and mo-

saics in the sanctuary and the golden linings of the niches in the bases of the pendentives.

A keen observer entering the church by day would wonder how it is lighted at night, as the only fixtures in evidence are small electric clusters on the flat ceiling under and over the galleries, gas standards on the gallery rail-

Fig. 1—Illumination of Sanctuary.

ings and gas brackets here and there upon the walls. Nothing even remotely hints that the four great niches above the pairs of columns play an important part in the artificial lighting scheme; for, although apparently resting upon the frieze, each extends behind it sufficiently to accommodate a specially designed Frink reflector which throws the rays from twelve 60-watt clear-bulb, tungsten-filament lamps up against the parabolic mosaic lining, by which they are diffused over the area beneath the dome after absorbing a soft golden tint closely approximating sunshine and wonderfully harmonious with the color scheme of the structure.

As the sanctuary occupies a space outside of the main area of diffusion from the niches, special lighting for it

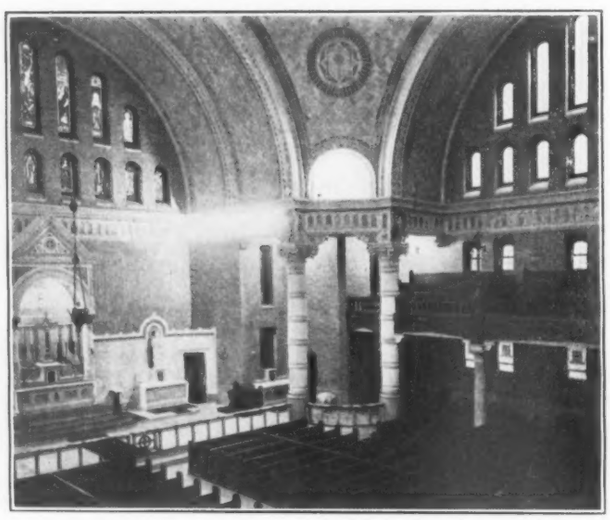


Fig. 2—Concealed Lighting in Holy Trinity Church.

has been provided by means of individual 25-watt tungsten lamps projecting horizontally from receptacles set flush in the eighteen panels of the frieze at each side. These lamps, being unfrosted, are not noticeable until lighted.

The illustrations reproduced herewith show all of the available incandescent lamps turned on. For ordinary services, however, only the niches and a portion of the sanctuary frieze lamps are used; yet the smallest prayer-book can be read in any of the pews, while the color tone of the light and the entire absence of glare result in an unusually quiet, restful effect.

The clusters under the galleries are not needed during services, but, as they are used when the church is open

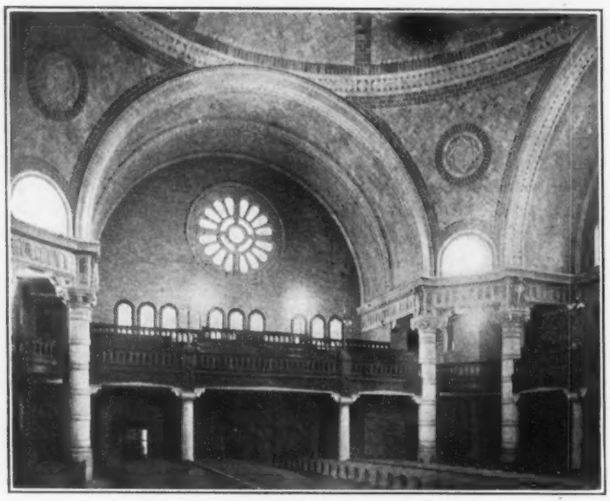


Fig. 3—Rear of Holy Trinity Church.

for private devotions, it is intended to equip them with amber-colored lamps, so that they will be more in harmony with the light from the niches. The chief supply of natural light is obtained through a 17-ft. skylight forming the center of the dome 70 ft. above the floor, in order that the church lighting may be uninfluenced by the height of surrounding buildings. Above the skylight there is an arrangement of lamps in individual reflectors similar to that used behind the huge clerestory windows of the Cathedral of St. John the Divine and, like them, to be used only on festival occasions. The vestibules, sacristies, etc., being in themselves more or less conventional, are equipped with lighting fixtures in the conventional way.

Mr. Joseph Hubert McGuire was the architect of the structure and Mr. James Robert Moore was the consulting engineer.

UNDERGROUND DISTRIBUTION FOR SUBURBAN DISTRICTS.

Where the business will warrant the investment for underground construction, general opinion favors putting all wires underground in cables. The need of a cheap form of cable construction for suburban districts, as pointed out by Mr. Hugh T. Wreaks, New York, chairman of the committee on "underground systems" of the Western Association of Electrical Inspectors, is being very practically felt at this time, when there is agitation regarding the injurious effects of wires in trees.

For the street type of distribution, the underground system in the suburban or residential section would in general be the same as used in the more congested business district, except that the number and size of conduits and manholes may be reduced in proportion to local requirement. Usually a four-duct system of distribution is sufficient. This allows one duct each for street-lighting cable, feeder cable and distribution mains and a spare one for future growth.

A cheap form of construction makes use of fiber ducts incased in concrete, with manholes and distribution holes also of concrete. A system of this kind will cost, on macadam streets, from $5,400 to $5,800 per mile, allowing a 4-ft. by 4-ft. manhole every 400 ft., and 30-in. by 30-in. distribu-

tion holes every 200 ft. The duct would be laid 30 in. below the grade of the street, with 2 in. of concrete on all sides. The cost of service connections runs 12 cents to 15 cents a foot, exclusive of pipe. The service pipe is wrought iron from manhole and distribution hole to curb line, thence fiber duct across sidewalk and lawn to customer's premises.

Back-yard or interior-block distribution has been used extensively in many suburban sections. As far as appearances go, this plan possesses all the advantages of a conduit system, and its cost is not much greater than that of an overhead system.

This system is also adapted to residential blocks without alleys. From short-pole distribution lines located on the rear property lines of the lots overhead services are run to the rear of the houses. These distribution pole lines are fed by an underground low-tension main, run from a transformer manhole in the street. In Rochester, N. Y., the lighting company has deeded to it by the owner the ground on which the pole is erected, together with the right of free access at all times. In turn, it places on the streets an improved type of arc lamp-post. The property owners appreciate keeping the streets free from poles and readily grant rights to the ground upon which the poles stand.

In the sidewalk system of distribution the conduit is usually laid in the grass plot between the curb and the sidewalk, with hand holes located at every other lot line, from which holes the service pipes lead to the meter boards in the basements. Sometimes the boxes, cover and all, are sunk below the sidewalk level and grassed over. A record of their exact location is kept in the operating office, so that they may be quickly located in case of trouble. The duct may be of either fiber or iron pipe, the former being considerably cheaper. It is not necessary to lay the duct in concrete, as a special sleeve can be employed which is sufficiently strong to keep proper alignment of the duct during the refilling of the earth. The ends of the duct are tapered and fit tightly into these sleeves, which are about 5 in. long. Cement-covered joints can be used even when the conduit is not entirely laid in concrete. The joint is wrapped in muslin before applying the cement, to prevent mortar from entering the conduit.

LINE-POLE STATISTICS.

The Bureau of the Census has issued a report of "Poles Purchased in 1910," which was compiled through the cooperation of the Census Bureau and the Department of Agriculture. It is stated that the total number of poles purchased in 1910 was 3,870,694, and that although this is the largest total ever recorded, it is only 131,954 greater than in 1909. The increase reported for 1909 over 1908 was much greater, amounting to 489,586 poles. The number of poles purchased each year from 1907 to 1910, inclusive, is shown by species in Table I.

TABLE I.—POLES PURCHASED, CLASSIFIED BY KINDS OF WOOD; 1907 TO 1910.

Kind of Wood.	POLES PURCHASED (NUMBER).			
	1910.	1909.	1908.	1907.
Cedar	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	677,517	608,066	516,047	630,282
Oak	265,290	236,842	160,702	76,450
Pine	184,677	179,586	116,749	155,960
Cypress	75,459	77,677	90,579	100,368
All other	236,184	196,744	164,936	210,731
Total	3,870,694	3,738,740	3,249,154	3,283,268

The demand for wooden poles, now amounting to nearly 4,000,000 annually, is supplied principally from three different sections of the United States, the northern white cedar region of the lake states, the chestnut region of the eastern portion of the United States, and the western red-cedar region of the Northwest, including Idaho, Washington and Oregon. Southern white cedar, or juniper, is found mainly in North Carolina, Virginia and New Jersey. At present the largest part of the cedar used is cut in the lake states, but the indications are that the Northwest will be called upon to supply a constantly increasing proportion.

The qualities most desired in a pole timber are durability, strength, lightness, straightness, and a surface which will take climbing irons easily. The various species of cedar combine these qualities in a high degree. Next to cedar, chestnut, oak and pine were the leading woods drawn upon. The demand for these four species grows greater each year. Over 80 per cent of all poles reported were of cedar or chestnut, cedar alone supplying nearly 62 per cent of the total. The number of cedar poles increased slowly during the last few years up to 1909, but shows a slight decrease in 1910. The use of chestnut poles fell off considerably from 1907 to 1908, but since the latter date has again increased.

The number of oak poles purchased shows a heavy increase throughout the period covered by the table, the number purchased in 1910 being more than three times that reported in 1907. Various species of oak are utilized in different parts of the country, the more durable varieties of the white-oak group being preferred. The number of pine poles has shown a slight increase for each year except 1908. Several species of Southern yellow pine are used to considerable extent, principally in the Southern States. In the West another species, the Western yellow pine, is reported. The latter is seldom used for poles without preservative treatment.

The number of cypress poles purchased seems to be falling off, the number reported for 1910 being only about three-fourths as great as in 1907. Cypress poles are cut only in the Southern States, mainly in Arkansas and Missouri. The use of Douglas fir in the Northwest is growing rapidly. Over 56,000 Douglas fir poles were reported in 1910, as compared with about half this number in 1909 and less than 16,000 in 1907. Poles of several other kinds of woods were purchased in quantities of less than 50,000, of which tamarack, redwood, osage, orange, spruce and juniper were the most important. More than a dozen other woods were utilized to a relatively small extent.

TABLE II.—POLES PURCHASED, CLASSIFIED BY LENGTH AND BY KINDS OF WOOD; 1910.

Kind of Wood.	POLES PURCHASED (NUMBER, BY LENGTH).					
	Total.	Under 20 Ft.	20 Ft. and Over but Under 30 Ft.	30 Ft. and Over but Under 40 Ft.	40 Ft. and Over but Under 50 Ft.	50 Ft. and Over.
Cedar	2,431,567	302,131	1,527,953	463,494	113,629	24,360
Chestnut	677,517	29,764	331,725	254,874	50,869	10,285
Oak	265,290	157,898	88,127	12,959	4,870	1,436
Pine	184,677	62,394	74,345	33,134	9,451	5,353
Cypress	75,459	10,464	37,202	21,954	4,451	1,388
All Other	236,184	79,308	128,099	21,354	5,866	1,557
All kinds	3,870,694	641,959	2,187,651	807,769	189,136	44,379

The telephone and telegraph companies, which are the principal consumers of poles, reporting 73.2 per cent of the total number used, purchased 84,195 fewer poles in 1910 than in 1909. The electric railway and electric light and power companies, on the other hand, purchased 105,678

more poles than in 1909, while the steam-railroad companies purchased 110,471 more poles than in the preceding year.

In Table II the purchases of poles in 1910 are classified by length for the principal kinds of woods.

Poles are classified commercially in 5-ft. lengths and by diameters at specified points. For the purposes of this report poles are divided into classes differing in length by 10 ft., as shown in the table. More than one-half of the poles purchased are from 20 ft. to 30 ft. long, this being the length most commonly used by the telegraph and telephone companies. About one-fifth are from 30 ft. to 40 ft. in length and one-twentieth from 40 ft. to 50 ft. Only about 1 per cent of the poles purchased exceed 50 ft. in length. Cedar was the preferred wood for all lengths, and, in fact, in every class shown in the table, except that of poles less than 20 ft. in length, cedar poles constitute more than one-half of the total. Poles of less than 20 ft. in length are used largely by the rural telephone companies, which report a considerable variety of woods, prominent among which is oak.

The increase from 1909 to 1910 in the total number of poles purchased was 3.5 per cent. The largest increase for any of the several classes was that for poles over 50 ft. in length, 23.5 per cent, and the next largest that for poles from 40 ft. to 50 ft. in length, 16.9 per cent. A slight decrease is reported for poles from 20 ft. to 30 ft. long.

Since the quantity of wood used for pole-line accessories is not reported for 1910, it may be interesting to note that the statistics gathered in 1909 show the purchase in that year of 3,508,695 cross-arms, 6,167,795 brackets and 18,463,041 insulator pins. Cross-arms are made principally of Douglas fir and pine, brackets of oak, and insulator pins of locust.

PRESERVATION.

For a number of years past experiments have been carried on by private parties and by the United States Forest Service with a view to finding and perfecting methods of preventing such decay, and it may be stated that it is possible, through the proper application of certain preservatives, to increase the life of a pole from 50 to 100 per cent. The practice has proved a success economically. Not only does it lengthen the life of the pole, but it makes possible the utilization of many cheap local woods which without preservative treatment would be valueless for the purpose, thus reducing the cost of poles and transportation charges. In the principal European countries the practice of pole preservation is much more common than in this country, nearly every pole receiving a penetrating treatment with some preservative before being set. The economy of the process has been so well established that as it becomes generally understood the percentage of treated poles reported in the United States will no doubt rapidly increase and the methods used become more effective each year. The preservatives most commonly used are creosote oil, a solution of zinc chloride and various proprietary preparations, usually antiseptic oils of low volatility.

The increase in the practice of really effective pole preservation in the United States has been retarded by the lack of pole-treating apparatus applicable to the needs of the small consumer. As a result poles have been treated mainly by methods which do not require the use of a special treating plant and which add but few years to their service. The usual method is that of painting the lower end of the pole with the preservative.

A somewhat more effective method is that of dipping the pole in an open tank containing the preservative. By this operation all seasoning checks are thoroughly penetrated. A variation of this method is to stand the poles upright in a bath of the preservative, making the wood of the butt end of the pole decay-proof by the absorption of large quantities of the oil or solution, through the action of a partial vacuum in the wood cells created by the alternate raising and lowering of the temperature of the bath. Satisfactory plants have been devised for this purpose which are economical for firms using considerable numbers of poles annually. A plant of this type and of large capacity was built during the year in California for the treatment of Western yellow pine, Western red cedar and other local woods.

In parts of the South conditions are so favorable to decay that it is desirable to treat the entire pole, and both commercial and private plants have been established for this purpose. The poles are placed in a closed cylinder and absorption of the preservative is secured by the use of pressure. Large numbers of pine poles have been treated by this method, which is found to be the most effective.

The number of poles which were treated before or after purchase from 1907 to 1910 by the concerns reporting is given in Table III.

TABLE III.—POLES PURCHASED ALREADY TREATED OR TREATED AFTER PURCHASE; 1907 TO 1910.

	POLES TREATED (NUMBER).			
	1910.	1909.	1908.	1907.
Treated before purchase.	166,211	126,711	101,998	106,781
Treated after purchase....	658,462	449,920	242,390	289,418
Total.....	824,673	576,631	344,388	396,199

The table shows a continuous and rapid growth of the practice of treating poles. In 1910 some form of preservative treatment was administered to nearly 825,000 poles, or 21.3 per cent of the total number purchased. This is an increase of 248,000 over the number treated in 1909, and of 480,000 over the number treated in 1908.

By far the larger part of the treated poles were treated after purchase, the increase in the number treated after purchase during the past few years being much more rapid than that in the number treated before purchase. The electric railway and electric light and power companies have been especially active in pole preservation. These companies treated nearly 30 per cent of their poles, while the telephone and telegraph companies and the steam-railroad companies each treated less than 20 per cent of their poles. These percentages indicate a large gain for each class of purchasers except the steam railroads, which treated 31.1 per cent of the poles purchased by them in 1909.

Reports to the Forest Service in 1910 from seventy-one commercial and private timber-treating plants show that 457,352 linear ft. of pole timbers, or the equivalent of 18,294 poles 25 ft. long, were treated in closed cylinders under pressure. Four plants failed to report on this subject. This total is only about 40 per cent of that for 1909, when 1,123,000 linear ft. were reported. Most of this timber was Southern yellow pine treated in Southern plants. Although some of these poles were treated with a solution of zinc chloride, by far the larger part were impregnated with creosote oil, from 6 lb. to 20 lb. being used per cubic foot of timber. In co-operation with private firms the Forest Service has conducted experiments in pole preservation and now has a number of long pole lines under complete record. From the data thus collected the comparative life of various timbers treated by different processes is being determined.

Although the number of treated poles reported is growing rapidly each year, most of these poles receive a merely superficial treatment which adds only a very few years' service. The figures for 1910 indicate that a larger proportion of the poles were treated during that year by the brush and open-tank methods than in the preceding year. Future progress in pole preservation should show not only increases in the number of poles treated but an increasing use of the more effective methods of preservation.

Letters to the Editor.

VOLTAGE EMPLOYED IN NEW YORK PUBLIC LIBRARY.

To the Editor of Electrical World:

SIR:—In your issue of Dec. 2, which has just reached me, I note with interest an account of the electrical equipment and lighting arrangement of the New York Public Library.

What interested and indeed surprised me most in connection with the article describing this installation is the statement that it is a two-wire, 250-volt system. I remember reading in your columns not long since a criticism by a well-known illuminating engineer of the lighting of this building from an illuminating standpoint, and I cannot help being curious as to whether this system of voltage and distribution was the object of criticism.

Having had occasion during several years to be engaged a number of times in the consideration of the relative merits of three-wire, 110/220-volt as compared with two-wire, 220-volt systems, under various conditions of operation, where a new lighting system for a town or an isolated plant was about to be installed, I am much interested to know more of the reasons which caused the adoption of the latter system for the New York Public Library.

The almost universal adoption of the three-wire, 110/220-volt system in the United States has caused it to be considered practically as standard practice. In fact, I remember reading in your columns some time ago in connection with the discussion of this question at some electrical engineering convention that one member remarked there might possibly be a good reason for using a two-wire, 220-volt system in some small town where the houses were greatly scattered. The reply was that such a town would not be a very profitable field for an electrical plant and if a three-wire system could not be profitably installed and operated it was best not to venture the establishment of an electrical plant in the town.

Of course, there are manufacturing plants where the question of lighting is of decidedly secondary importance as compared with the motor load. This could hardly be the case, however, in a public library.

In the case of the New York Public Library the question is dismissed in the article mentioned by simply saying that the large motor load and great length of feeders caused the adoption of a two-wire, 250-volt system. It would seem to me that these very reasons might properly be given for adopting a three-wire, 125/250-volt system, for does not the fundamental advantage of such a system lie in the fact that you have available the 250 volts for the motor load and for distributing the lighting current throughout the building over the feeders, while there is the very decided advantage of having the 110 volts for the lamps? The advent of the tungsten-filament lamp has even increased the advantages possessed by this system. Also, in the case of various other apparatus, such, for instance, as heating devices, it is found that the apparatus for 125 volts is cheaper and more durable than that for 250 volts, while many newly marketed special devices are not made at all for 250 volts.

The question of the relative merits of these two systems is not much discussed in the United States owing to the fact that the three-wire, 110/220-volt system is almost universally used except for special purposes. I have found considerable discussion of this question, however, in Europe, where there are many two-wire, 220-volt plants, and especially in England, where this latter system is almost universal. I have found much interest, therefore, in discussing this question with various engineers in Europe, and particularly in England, where almost every prominent engineer must feel himself more or less responsible for the existing system. Of course, it could not be expected that engineers engaged in designing, building and operating these systems would say that they were wrong; nevertheless, I felt that their opinion was evidenced by one who remarked to me that they considered that the art must grow to their voltage rather than that they should change their voltage, at this date, to gain the advantages offered under the present development of the art. This undoubtedly was the only possible attitude in his case, but in the case of a new installation such as the New York Public Library, installed in a country where three-wire, 110/220-volt practice with its many advantages is almost universal, I cannot but ask whether or not there has been any criticism of this installation or whether there are important considerations not mentioned in the article in the *Electrical World* which led to its adoption.

H. E. YOUNG,
Manila, P. I. *City Electrician.*

DEFINITION OF SPEED REGULATION OF MOTORS.

To the Editor of Electrical World:

SIR:—The definition of speed regulation of a constant-speed direct-current motor as given by the Standardization Rules of the A. I. E. E. is: "Ratio of the maximum variation of speed from its rated load value (occurring within the range from rated load to no load) to the rated load speed." Though it is not explicitly so stated, I believe the general understanding of this term is that it is the maximum variation of speed due to change of load only. I believe it is usual to test for the "speed regulation" by measuring full load speed and zero load speed at approximately the same temperature, keeping the voltage constant at rated value. I understand that "regulation" is intended to express that change in speed which will take place inherently or automatically when the load is removed so rapidly as to render it impossible to *control* the speed, or to keep it constant by adjustment.

Recently I had occasion to perform acceptance tests upon several shunt motors of a consignment intended to drive wood-shop tools. Before and after the heat run I had taken several observations of speed at constant rated voltage as follows: Full load speed at room temperature before heat run, 1750 r.p.m.; full load speed at maximum running temperature (full load), 1850 r.p.m.; zero load speed at maximum running temperature (full load), 1960 r.p.m.

On the basis of the usual understanding I reported the speed regulation as $\frac{1960 - 1850}{1850} = 6$ per cent, venturing my opinion that this is a reasonable value for a 3-hp motor. The purchaser, who is a mechanical engineer, contended that the speed regulation should be calculated as $\frac{1960 - 1750}{1750} = 12$ per cent, which is an unreasonable value for his purposes. I am inclined to think that he is correct in this argument, and that, inasmuch as the motor is not regularly sold equipped with field rheostat and tachometer and free attendance or automatic regulator, by which its speed changes due to the temperature rise may be compensated, the definition of "speed regulation" should plainly and explicitly include *all* inherent changes of speed from full load to no load at constant voltage. Either it should be defined as the ratio:

$$\frac{\text{Full load speed at room temperature} - \text{zero load speed at maximum running temperature}}{\text{Full load speed at room temperature}}$$

all measurements being taken with constant room temperature, or there should be two components of speed regulation defined separately, the total regulation being the sum of the two—one due to change of load at constant temperature and the other due to change of running temperature at full load. I should be glad to get information and opinions on this point.

Boston, Mass. H. H. HIGBIE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Motor-Car Lighting Dynamos.—J. D. Morgan.—An abstract of a paper read before the Birmingham Section of the (British) Institution of Electrical Engineers. The first describes the Blériot machine and then a new machine by Trier and Martin, which is illustrated in Fig. 1. The machine is of the two-pole shunt-wound construction, with a

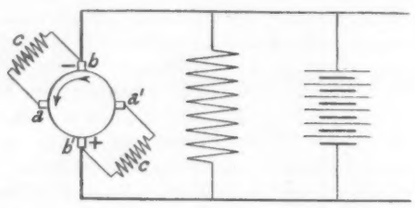


Fig. 1—Connections of the Trier and Martin System.

pair of intermediate brushes *a a'* midway between the ordinary main brushes *b b'*. The main brushes and interbrushes are connected together through resistors *c*. As *b* is the negative and *b'* the positive brush, the current in the resistor connecting the main brush *b'* with the auxiliary brush *a'* will, when the machine is running on open circuit, flow from *b'* to *a'*, and in the resistor connecting the other pair of brushes will flow from *a* to *b*. The effect of these currents is to strengthen the main field. As the load increases, the armature reaction displaces the axis of the field forward, and the magnetic field is reduced. When the axis of the magnetic field is displaced by 45 deg. there will be no current between the main and auxiliary brushes. A further displacement of the magnetic field will cause a current to flow again between the main and auxiliary brushes in the reverse direction, and its effect will be to weaken the main field. Thus the output of the dynamo becomes self-regulating. Another machine is the Midgley-Vandervell machine. This is of the Rosenberg type, depending for its regulating property upon the short-circuting of certain armature coils. The principle is illustrated in Fig. 2. Two opposite pairs of poles *a* and *b* are united by the body *c*. The poles *a* are provided with shunt-connected windings, while the poles *b* are left unwound. Current is supplied to the external circuit by the armature turns under the poles *b* through brushes *d*, and the armature is wound in such a manner that the brushes also short-circuit armature coils

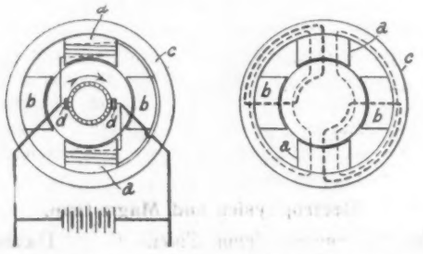


Fig. 2—Arrangement of the Midgley-Vandervell System.

lying in the neighborhood of the leaving edges of the poles *a*. The initial path of the magnetic flux is indicated diagrammatically by the thin dotted lines. When the current in the short-circuited coils reaches a certain value, the flux swings into opposite quadrants as indicated by the thick dotted lines. At this stage the machine becomes self-regulating, as the cross-magnetization due to the armature coils under the poles *b* counteracts the principal flux and so progressively weakens the field as the speed increases. This machine requires the presence of the battery before its self-regulating property can be asserted. The self-regulating system of Grob is also mentioned.—London *Elec. Eng'ing*, Feb. 8.

Cooling of Electrical Machinery.—H. A. Carney.—A note referring to the possible use of water for the cooling of electrical machinery. If the temperature limit could be raised to such a point that the heat generated in the machinery would raise the temperature of the water employed in cooling it to about 100 deg. C. it would be possible, without exceeding the somewhat higher limit of maximum temperature so adopted, for the insulation to increase enormously the output of the machine, since the cooling water, having been heated up to 100 deg. C., would, of course, on further heating, be converted into steam without rise in temperature. The considerably increased output which could thus be got from a machine of given dimensions would probably be found to outweigh entirely the cost of specially insulating the machine to withstand the higher temperatures in its internal parts, and also make feasible the provision of means whereby the steam could be condensed and fed back into the casing of the machine as water, thus rendering remote the chance of the cooling apparatus becoming dry. By the choice of suitable liquids which, while having good specific heats, have also low boiling points (below 100 deg. C.) much might be done.—London *Electrician*, Feb. 9.

Heat Tests of Dynamos.—A. J. Makower.—A communication referring to the short-time heating tests of S. P. Thompson recently abstracted in the *Digest*. The author points out that Thompson presupposes that the machine under test is perfectly homogeneous and that the cooling is the same for all its parts, but as neither of these conditions is fulfilled in practice, it might be expected that the proposed method would not give reliable results. Some thirty tests made for this purpose showed that only in about one-quarter of these cases is the calculated value of the temperature rise within 20 per cent of the correct figure, and that in many cases the error is as much as 50 per cent above or below the true figure. The method is perhaps more nearly accurate in the special case of absence of air ventilation.—London *Electrician*, Jan. 12.

Voltage Drop of Transformers.—R. Hunzinger.—A mathematical article in which the author derives formulas for the voltage drop of transformers at different phase differences and describes a simple graphical method of determination.—*Elek. Zeit.*, Feb. 8.

Short-Circuiting of Alternators.—P. Boucherot.—His long illustrated mathematical Turin Congress paper on the electromagnetic phenomena which result from the sudden short-circuiting of an alternator.—*La Revue Elec.*, Feb. 9.

Lamps and Lighting.

Drawn Filament.—A note on a recent British patent (No. 1161, of Feb. 1) of the Deutsche Gasglühlicht Ges. To render drawn filaments indifferent to alternating current, a calcium compound, which is readily converted into an oxide and which is irreducible by hydrogen or other powerful reducing gases, is added to the usual mixture of tungsten and auxiliary metals, in the form of a dilute solution, in such quantities as correspond to from 0.3 to 0.6 per cent of the calcium oxide. The calcium can be combined with any acid, because, by hydrolysis and heating to incandescence, calcium oxide is finally formed more or less completely. After drying, the mixture is reduced with hydrogen and then formed into small rods by sintering, from which very fine wires can be drawn.—London *Elec. Eng'ing*, Feb. 8.

Generation, Transmission and Distribution.

Turbo-Alternator.—The Saint-Denis central station in Paris contains at present ten turbo-alternators, each of 10,000 hp, but a new unit of 25,000 hp is now being installed, the total length being 13.6 m (45 ft.), of which 8.5 m (28 ft.) is the length of the turbine and 5.1 m (17 ft.) the length of the alternator. The weight of the unit is about 300 tons, the turbine alone weighing 140 tons and the alternator 90 tons. Some of the parts of the unit were so large that they could not be transported by railroad but had to be transported by wagon.—*La Revue Elec.*, Feb. 9.

Voltage Drop.—W. GENKIN.—The author investigates graphically the following problem. Given an alternating-current distribution, such as the combination of a central station with a transmission line and a load at the receiving end, the impedance of the line causes a certain voltage drop. The problem is to determine the conditions at the receiving end from those at the central station, or, inversely, if a constant voltage is impressed at one or the other of these terminals. The solution given by the author is very simple, the diagram of the central station and that of the receiving end being "inverse figures." The method is applied to various special cases.—*La Lumière Elec.*, Feb. 3.

Installations, Systems and Appliances.

British Supply Stations.—Statistical tables giving data on the growth of stations supplying energy for only lighting and stationary motor service, stations taking a bulk supply, and stations having a combined lighting, stationary motor and traction load respectively.—Supplement to London *Electrician*, Jan. 26 and Feb. 2. Results of these tables are now summed up in the form of diagrams. They show that the load on the provincial stations is now almost three times that of the London stations. In 1909, for the first time, the connections to the provincial stations exceeded 1,000,000 kw, and since then the rate of progress has been well maintained. The total connections to purely direct-current or alternating-current stations remain almost stationary, even in some cases decreasing, while the number and output of combined stations is steadily increasing, showing that as the area of supply is enlarged opportunity is taken to install alternating-current plant for the supply of outlying districts.—London *Electrician*, Feb. 9.

Auto-Transformer Distribution.—A note on a recent British patent (No. 4618, Jan. 25, 1912) of F. Kesselring for a method of cutting out the primary circuit when no supply is being taken in connection with an auto-transformer system of distributing energy to a number of consuming devices in parallel. One of the primary feeders is directly connected to one terminal of the transformer. The other feeder consists of two free conductors, one of which is connected to the second terminal, which is therefore free, the two conductors being connected by means of a switch. Each consuming device is connected across a tapping on the winding and the free terminal by means of one of these switches, which when closed connects the two terminals of the transformer to the feeders, and at the same time the consuming devices are joined to the secondary. The primary circuit is therefore opened when the last consuming device is switched off.—London *Elec. Eng'ing*, Feb. 1.

Supply of Energy in Agricultural District.—F. HUBER.—The three-phase, 3000-volt central station of Plauen, in Saxony, has developed a distribution system in the suburbs and sixty-four towns in the neighborhood. For transmission the voltage is raised from 3000 to 10,000. The transmission line is placed underground, while the distribution from the transformer stations in the different towns is carried out by overhead wires, the voltage being 210 for motors and 120 for lamps.—*Elek. Zeit.*, Feb. 1.

Bury.—The majority of the large electric supply stations in Great Britain which had formerly adopted a three-wire direct-current system have supplemented it later or are doing so now with the three-phase supply. The latest to do so is the Bury municipal station, which has in operation 2260 kw of direct-current equipment. A three-phase plant has now been installed containing two turbo-alternators, each of 2100-kw rating, operating three-phase currents at 6000 volts with a frequency of 50. To use the three-phase currents for supplying direct-current energy to help the direct-current plant, two 500-kw motor-generators have been installed.—London *Electrician*, Feb. 9.

Wires, Wiring and Conduits.

Measuring the Effective Capacity of High-Tension Cables.—G. W. STEWART AND D. M. TERWILLIGER.—An abstract of a paper read at the Chicago meeting of the American Physical Society. The already known method of utilizing the partial capacities (in the case of a polyphase cable) is utilized, but the partial capacities are computed from the observations of a quadrant electrometer before and after dividing its charge with the cable. The method, therefore, depends upon the calibration and capacity of the electrometer. The results show that the effective capacity of a very short piece of cable, less than 50 cm (20 in.), can be measured with an accuracy of 3 per cent. The manufacturers of the cable tested state that the ballistic galvanometer method shows a temperature variation of from 10 per cent to 50 per cent between 60 deg. and 80 deg. Fahr., but the writers found no perceptible variation of the effective capacity between 23 deg. and 50 deg. C. The method here proposed eliminates practically all the effect of absorption. The other advantage is the requirement for only a short piece of the cable.—*Phys. Review*, January.

Testing High-Tension Cables.—A. LÉAUTÉ.—An illustrated description of a paper presented before the International Society of Electricians in Paris on a method of testing high-tension cables after they have been installed. The author points out the shortcomings of the use of a transformer and the disadvantages of using direct current for testing. In his method he uses alternating current and connects a specially designed self-induction coil in series with the cable and a source of constant potential which enables him to produce resonance effects.—*La Revue Elec.*, Feb. 9.

High-Voltage Tests and Energy Losses in Insulating Materials.—E. H. RAYNER.—Experiments made in the (British) National Physical Laboratory on insulating materials at a high voltage are described, the general aim of the research being to discover the effect on the electric strength of materials of the application for some time of a voltage that is from 30 to 90 per cent of that which will produce break-down for a few seconds. The physics of electric strain and the results obtained from measurements of the energy absorbed when insulating materials are subjected to alternating stress are also dealt with.—London *Electrician*, Feb. 9.

Wood and Concrete Poles.—W. MANKTELOW.—A continuation of his article. The author now deals with treatment of wooden poles by the copper-sulphate process (Boucherie), the corrosive-sublimate process (Kyan), the zinc-chloride process (Burnett) and various other impregnating processes, and gives some figures of cost. He then deals with the use of concrete poles for electrical purposes.—London *Elec. Review*, Feb. 9.

Electrophysics and Magnetism.

Positive Thermions from Salts.—C. J. DAVISSON.—An account of experimental measurements of the specific charge (ratio of electrical charge to mass) of the ions emitted by heated salts. The author has investigated various salts of barium, strontium, calcium and magnesium and believes that his results point strongly to the conclusion that the truly characteristic positive thermions from salts of alkaline earths are single atoms of these elements minus single electronic charges. In a second paper the author points out that these results do not contain any direct evidence against the hypothesis that in some cases all or a part of the

thermionic current is carried by carbon monoxide. The author has made experiments similar to those made by other investigators on the rôle played by gases in the emission of positive thermions from salts. His chief conclusions are that the carbon monoxide or carbon dioxide which is sometimes emitted by samples of salts when heated is uncharged. The increase of thermionic emission from a salt which is caused by the presence of a gas in contact with its surface is not due to an emission of gas atoms or molecules which have been absorbed by the salt and are emitted in a charged condition.—*Phil. Mag.*, January.

Units, Measurements and Instruments.

British National Physical Laboratory.—An abstract of the report for 1911 of the work of the British National Physical Laboratory. Comparative tests of sheet iron for total and hysteresis loss have been made in conjunction with the Bureau of Standards and the Reichsanstalt. The results show very satisfactory agreement between the three laboratories. In the electrotechnics division investigations have been made on alternating-current induction supply meters to determine the effect of railway and other journeys. Variations to the extent of ± 0.5 per cent were found, but erratic changes of this order also occurred when the instruments remained stationary on the test benches. British manufacturers have been consulted as to a method of marking meter phases, so that in the connecting up of three-phase meters there shall be no doubt as to how the elements are to be connected to the system. In the photometry section much work has been devoted to securing a series of high-efficiency electric incandescent lamp standards, the values of which have been carefully determined in terms of the unit of candle-power, and by means of which the constancy of candle-power measurements on high-efficiency metallic-filament and other lamps will be maintained.—London *Electrician*, Feb. 9.

Measurement of Inductances and Capacities with the Thomson Double Bridge.—S. J. Barnett.—An abstract of a paper read at the Chicago meeting of the American Physical Society. While the Thomson double bridge has been used extensively for the measurement of resistances, especially small resistances, it does not appear to have been used hitherto for measurements of inductances or capacities. For these it is often at least as convenient as is the ordinary bridge, and in some cases it offers important advantages. (1) For the comparison of two self-inductances L and N, the bridge is arranged as in Fig. 3, conventional symbols designating resistances, inductances, etc. When balances

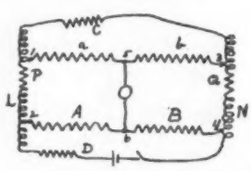


Fig. 3—Thomson Double Bridge

have been obtained for both steady and variable currents, $L/N = A/B\ (=a/b)$. The branches C and D may be either inductive or non-inductive. The bridge compares the effective inductance between the points 1 and 2 with that between the points 3 and 4. The inductance of the leads is eliminated. The inductance of the central part of a long solenoid traversed by a uniform current, which is simple to calculate, may be compared with any other inductance, provided that, as is usually the case, $A + B$ and $a + b$ are sufficiently large to insure that the current in all parts of the solenoid is practically the same. (2) To compare a self-inductance and a capacity, the branch 34 is made non-inductive, non-inductive variable resistances r and R are introduced between the galvanometer terminals and the points 5 and 6 respectively, and condensers with capacities s and S are inserted between the upper and lower galvanometer terminals and the points 3 and 4 respectively. A double balance will be obtained when $P/Q = A/B\ (= a/b)$, $S/s = r/R = a/A$, and $L = SQ\ [A + (A + B)/B\,.\,R]$. (3) To compare the mutual inductance M of two coils M and L with the self-inductance L of one of them, L, L is inserted as in the figure, the branch 3, 4 is made non-inductive, and M in series with an adjustable rheostat is inserted between the points 2 and 4. When the double balance has been obtained $M/L = W/[P + Q + (a + b)\ C/(a + b + C)]$, W designating the total resistance through M between the points 2 and 4. (4) To determine a self-inductance by comparison with a resistance and a time, one of the coils L in the figure is shunted with a non-inductive resistance Z, and a balance is obtained with an alternating-current supply of frequency f. Then

$$L^2 = [Q\ (P + Z)^2 - P\ Z\ (P + Z)\ B/A] \div [4\pi^2 f^2 (ZB/A - Q)],$$

and

$$N^2 = [Q - ZPB/A\ (P + Z)]\ (Zb/A - Q) \div 4\pi^2 f^2.$$

If the inductance under investigation is of the kind referred to in the last part of (1), it must obviously take the place of the unshunted coil N in the bridge. (5) To compare two capacities, the coils L and N are replaced by the two condensers with capacities S and S' respectively. When a balance has been obtained, $S/S' = B/A$.—*Phys. Review*, January.

Miscellaneous.

British Institution of Electrical Engineers.—An editorial commenting on the recent annual dinner of the British Institution of Electrical Engineers at which the president, S. Z. de Ferranti, outlined the "new policy" of the institution. The keynote of the president's speech was the idea that the institution should become the guardian of electrical interests in Great Britain. For many years there has been a strong feeling that the institution should take a more active interest in the commercial aspects of the industry; but the view expressed by members of the council has been to the effect that the object of the institution was to deal with purely technical matters.—London *Electrician*, Feb. 9.

Book Review.

Central-Station Heating. By Byron T. Gifford. New York: Heating & Ventilating Magazine Company. 208 pages, 37 illus. Price, $4.

Much useful information for the operating district-heating engineer who desires to analyze and improve his plant economies, as well as for the central-station man who contemplates expanding into the heating field, is contained in this reference volume on a subject whose literature is not large. The scope of the present work is general, covering both steam and hot-water heating, and extending from the broad subjects of franchises and business management, through plant operation and distributing-main construction, to suggestions for customers' installations. A number of plans for pipe-line construction are shown, and analyses are made of the various losses due to radiation, conduction, leaks and friction, with instructions how to figure and combine these. Methods of arriving at equitable rates for service, based on operating and overhead charges, form a valuable chapter in the book. Under the topic of the plant itself, the relative advantages and appropriate applications of steam and hot-water heating systems are compared, and a technical description of modern practices in the layout of plant equipment is included. Model franchises whose provisions offer the heating man fair and ample protection of his interests are reproduced in full and will prove useful to the company planning to enter the heating field. The final pages of the book are taken up with a collection of practical heating data and figures.

New Apparatus and Appliances

THE JOHNS-MANVILLE ANNUAL CONVENTION.

During the week ended Feb. 10 the H. W. Johns-Manville Company held in New York and Hartford its annual convention of electrical department managers and salesmen, at which over 100 men were present. Mr. J. W. Perry, general electrical manager, presided. A number of papers were presented during the convention on modern illumination, Westinghouse lamps, J-M Linolite, transite asbestos wood, overhead-line material, electrobestos insulation, friction tapes and splicing compounds, electrotherms, lightning arresters, asbestos products for electric power plants, inclosed fuses and fuses in subway boxes, insulating materials, overhead line material, etc. On Wednesday evening two special Pullman cars conveyed the attendants to Hartford, Conn., where the Johns-Pratt Company is located, for which the H. W. Johns-Manville Company is sole selling agency. Papers were presented at sessions held at Hartford, and some time was spent in the testing laboratories of the factory, where many interesting tests on high-tension fuses and boxes were made. On Saturday morning an inspection was made of the factory and in the afternoon of the substations of the Hartford Electric Light Company. On Saturday evening a banquet was given at the Hartford Club.

RELIANCE SPEED DIAL.

With the advent of high-speed steels and the continual trend toward scientific management and efficiency methods in all machine-tool operations, it is exceedingly important

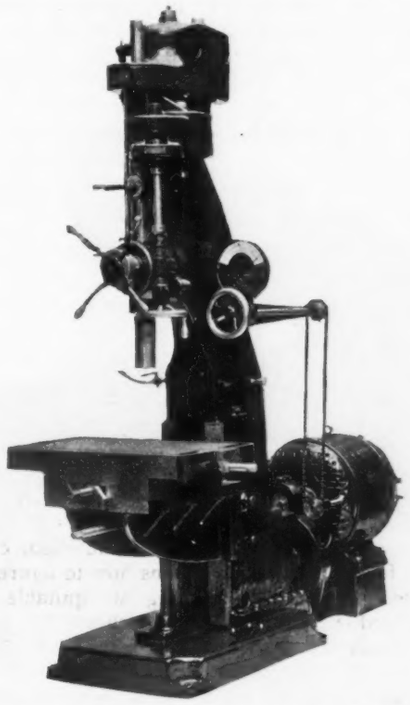


Fig. 1—Motor-Driven Drill Equipped with Speed Dial.

to have some accurate method by which the machine-tool operator can easily adjust his driving mechanism so as to give the prescribed speeds at the cutting tool under changing conditions of work. The Reliance adjustable-speed motor, shown herewith, which is of the armature-shifting type with an infinite number of speed changes, gives a smooth, gradual, continuous change in speed with no jumps. On a machine tool driven by this type of motor it is not necessary to make the approximations in speed setting required with other speed-change devices, and it is always possible to

Fig. 2—Speed Dial.

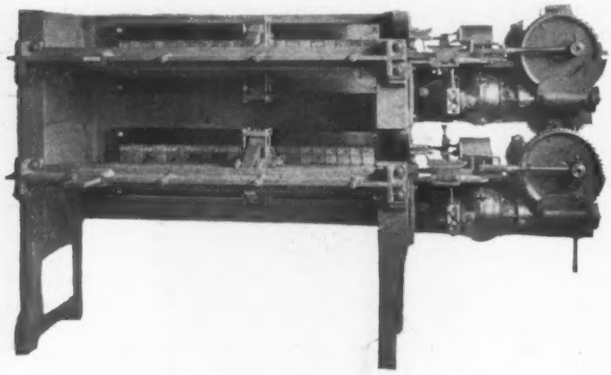
obtain the exact cutting speed desired, provided the operator has some means of accurately adjusting the speed of the motor to that required and does not have to guess at the speed at which the motor is running. Such a device has now been developed by the manufacturers of this type of motor and is shown in Fig. 2. This shows a dial arranged for a crank shaper with one back gear. The upper scale, indicating cutting speeds, is stationary. The small indicator standing at 40 is mounted on a revolving disk with two lower scales. The lower scales, showing length of stroke, are adjusted by means of a knurl on the front of the dial until the indicator points to the cutting speed desired, the scales not being shifted unless a new cutting speed is to be used. With the scales set for any cutting speed, the motor armature is then shifted by turning a handwheel illustrated in Fig. 1 until the pointer of the dial geared to the handwheel rod is opposite to the stroke to be used.

The Reliance speed dial can be mounted at any convenient point on the machine tool, and it is simply necessary that it shall have some positive connection with the means employed for shifting the armature of the motor. As the armature of the motor is shifted and the gradual change in speed obtained, a pointer moves in the speed dial. The scales in the dial take into account the different gear ratios between the motor and the work and can be set for different cutting speeds at the cutting tool, depending on the cutting steel used and the character of the work. The device is, therefore, not a means of indicating the speed at which the motor is running, but is in reality an automatic calculator by which the operator can instantly set the speed of the motor so as to give any desired speed at the cutting tool, taking into account all the variable factors which would affect the problem. All the operator has to do is to set the dial for the cutting speed to be used and then shift the armature of the motor in the usual manner until the pointer indicates the diameter of the cut to be taken on the proper scale for the gear combination used.

The dial not only serves as a guide in setting the speed accurately, but is always in plain sight as a definite indication to the foreman or inspector of the speeds in use by the operator. These dials, which are made for use with Reliance adjustable-speed motors on shapers, drills, lathes, milling machines, boring mills or any type of adjustable speed tool, are made by the Reliance Electric & Engineering Company, Cleveland, Ohio.

MOTOR-OPERATED END-CELL SWITCH.

The end-cell switch shown in the accompanying engraving is of the slide-bar and ratchet type, the bar being given a reciprocating motion and the brushes being caused to follow the motion in one direction or the other by means of pawls which engage with notches in the bar. The choice



Motor-Operated End-Cell Switch.

of pawls to be used is controlled by a second notched bar sliding in a slot in the first bar which transmits its motion to the brush. This second bar has the reciprocating motion of the brush-carrying bar and in addition can move longitudinally a short distance. The notches are so cut that when the bar occupies one position with regard to the brush-carrying bar the pawl for carrying the brush in one definite direction will fall into the notches which render it effective. In this position the second pawl is ineffective, as the second slide bar fills up the notches with which it could engage in such a way that the pawl slides smoothly on top of both bars. The second position of the inner or control bar renders the first pawl inoperative, and by bringing the second pawl into operation causes the brush to travel in the other direction. The relative position of the two slide bars is controlled by a transverse carriage on the mechanism bracket, which is moved by two solenoids. The latter have one common lead, while the other leads terminate at a double-throw control switch so designed that the blade will not remain in either clip but will fly to a neutral position whenever the operator releases the handle.

When the controlled switch is pressed to one side one of the solenoids is energized and the inside sliding bar takes a definite position with regard to the operating bar. The common connection of the solenoids is attached to the circuit through the driving motor, so that the latter starts simultaneously with the moving of the control bar. The motor drives a worm-wheel, to which is attached a crank which imparts the desired reciprocating motion to the operating bar. As this worm travels with approximately constant speed, the velocity of the slide bar may be represented by a sine wave. Thus, when the operating bar engages with the pawl it is traveling very slowly, and when the brush is changed from one contact to the next it is moving at its highest rate of speed. It is brought to rest gradually and is stationary when the bar starts its return stroke.

An auxiliary switch is provided, operated by a cam on the worm-wheel, which connects the motor directly to the circuit as soon as the brush is started on its travel. When this auxiliary switch is closed the control switch is ineffective, and the operator at the distant switchboard cannot interfere with the operation until the brush is stationary on the next contact. When this occurs the auxiliary switch controlled by the worm-wheel is opened, and if the control switch on the distant switchboard is also open the motor will stop. If not, the motor will continue to operate. When the brush has reached the last contact in either direction it cannot move further, because the notches which would cause such a motion are omitted from the slide bar, and, inasmuch as the brush cannot travel beyond this point because of this, no limit switch is needed.

The motor is mounted on a swinging bracket, which permits the worm to be disengaged from the worm-wheel in case it is desired to operate the switch by hand. Suitable indicators are also provided which show the exact location of the brush on its contacts. The motor always runs in the same direction, thus eliminating complicated wiring and an excessive number of complicated switches. From the switchboard the entire wiring consists of two control wires, two indicator wires and the connection to the power circuit. The switch is built by Messrs. A. & J. M. Anderson, Boston, Mass.

ARMATURE DISK NOTCHER.

The Ferracute Machine Company, of Bridgeton, N. J., has recently built the armature notching machine shown in the accompanying halftone. A prominent feature of this machine is its unusual depth of throat, which is necessary when the notching must be done at some distance from the circumference of the disk, for instance, in the rotating member of an alternating-current machine. These notchers are peculiar in having a very rapid action, much study having been expended to produce this effect. In medium-sized disks, for example, accurate work is produced at a speed of 200 strokes per minute.

The indexing mechanism is operated from the crank shaft by means of the bell crank shown at one side. The connection from this crank to the pawl lever is effected by a telescopic pitman made of steel tubing so that it can be adjusted to the different positions of the saddle (carrying the vertical indexing spindle) required by the varying sizes of disks. On the lower end of the indexing spindle is placed a large gear wheel into which engages the pinion that is on the same shaft as the ratchets. On the large gear is a projection which, when the wheel has made one revolution, throws out the clutch and stops the machine.

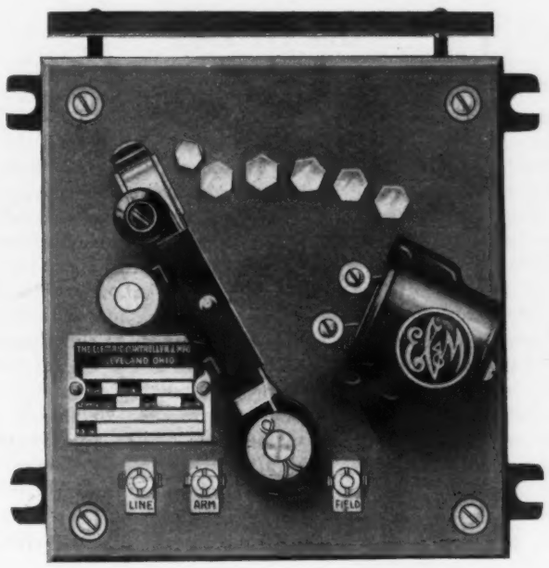
These machines are provided with a special brake which

Armature Disk Notcher.

enables them to be operated at the high rate of speed mentioned. The die-bed is adjustable vertically so that the die can always be set at the right height. The depth of the notches can be accurately secured by means of the screw movement of the saddle upon the bed. The depth of throat of machine illustrated is 20 in. There are two larger machines in this series.

MOTOR-STARTING RHEOSTAT.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, has recently placed on the market a new line of starting rheostats for series, shunt or compound-wound, direct-current motors. The manufacturers claim the following important advantages for these rheostats:



Starting Rheostat for Motors Up to 7½ hp.

The highest grade of Monson slate is used, having beveled edges and oil finish. On all sizes the contacts are removable from the front of the rheostat without disassembling or interfering in any way with the wiring or resistance. The retaining magnet is ironclad, thus being protected from mechanical injury. The resistance wire, the capacity of which is liberally proportioned, is wound on asbestos-covered, metallic tubes through which a draft of air flows. While this draft of air very efficiently conveys the heat away from the resistance, yet it does not at any time touch the hot resistance wire, the obvious result being unusual freedom from oxidization of the resistance wire.

The rheostats are made in sizes from ¼ hp to 35 hp, 110 volts, and from ¼ hp to 50 hp, 220 and 550 volts. Starters similar to that shown herewith are made for motors up to and including 7½ hp, 110 volts, 15 hp, 220 volts, and 20 hp, 550 volts.

POTHEAD FOR 3,000-VOLT DISTRIBUTION CIRCUITS.

The Fairmount out-door weatherproof pothead for 3000-volt distribution is equipped to screw on to iron conduit and also has no-wiped-joint cable sheath clamping members, such as are used on the company's station and disconnecting types. The no-wiped-joint clamping feature provides a simple and inexpensive means (by using the lead sheath as a gasket) for effectively sealing against moisture and prevents the lead from being forced into the insulation. This means is equal in effectiveness to the wiped joint and has the advantage of not requiring the services of a plumber or cable splicer.

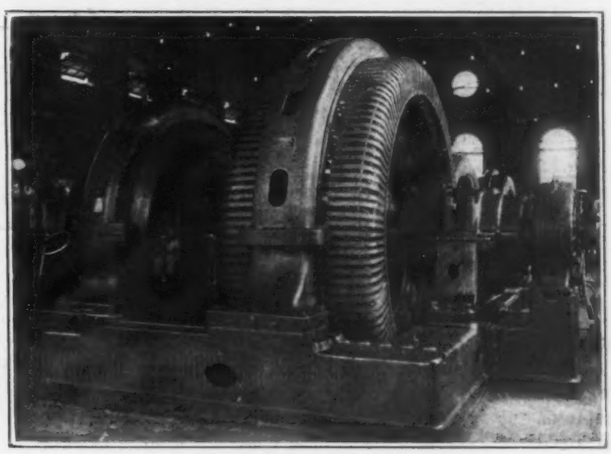
The body of the end bell is of iron heavily galvanized, and the sheath clamping members are of brass. A porcelain plate is provided inside of the end bell to separate the conductors from each other and from the metal sides of the end bell. A feature is that the conductors can be brought out of either side of the end bell after it is in place for convenience of overhead connections, the outlets being so constructed that they are interchangeable and are equipped with blank plugs for closing the outlets not in use. The illustration shows one porcelain tube on each side; also blank plugs in place. The outlet tubes and separating plate are of glazed high-tension porcelain. The dimensions of

Weatherproof Pothead.

end bell are: Hood, 10 in.; base, 5 in., and height, 12 in. The device is made by the Fairmount Electric & Manufacturing Company, Philadelphia, Pa.

SYNCHRONOUS MOTOR-GENERATOR SET FOR POWER-FACTOR CORRECTION AND MECHANICAL LOAD.

An interesting application of a Westinghouse synchronous motor-generator set is that in the tunnel substation of the Pittsburgh Railways Company, where such a set is used for power-factor correction and driving a mechanical load. The machine consists of a 1500-kw synchronous motor-generator set running at 360 r.p.m. The generator is wound for 550 volts, direct current, and supplies energy to the trolley system. The motor, wound for 10,000 volts, 60 cycles, has a rating of 2340 kva and is especially designed for operation at 70 per cent power-factor for corrective purposes. The size of the motor with respect to the generator is shown in the illustration. At present the load on the system supplying the motor-generator is of such a nature as to make advisable the operation of the set at only



Synchronous Motor-Generator Set.

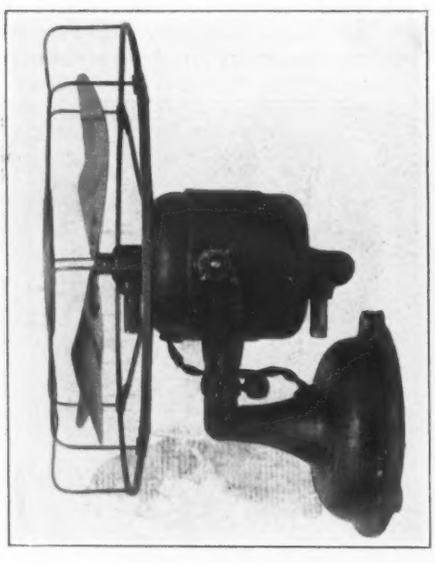
100 per cent or at very slightly leading power-factors. In the event, however, of a change in the character of the load there is available for power-factor-correction purposes, in addition to the corrective effect of the power component furnished to the direct-current generator, 1635 leading wattless kva.

CROCKER-WHEELER ELECTRIC FANS.

The Crocker-Wheeler Company, Ampere, N. J., is putting on the market 9-in., 12-in. and 16-in. fans which are characterized by lightness of weight. In appearance the fans are rich but quiet. The fans and fan guards are finished in polished and lacquered brass with the Crocker-Wheeler red and black enameled symbolical name-plate in the center of the guard. The motor frames and stands or brackets are finished in a polished black enamel on the 12-in. and 16-in. sizes and in a black lacquer on the 9-in. size. The brass fan guards are light and graceful in appearance but strong enough for the fan to be lifted by them without danger. The fans are all provided with four blades of polished brass. Particular attention has been paid to making the shape of the blades such that they will move the greatest quantity of air consistent with noiseless operation and without expending too great an amount of energy.

The smallest size, intended to make only a light draft, is usually placed on desks or brackets in the office. For this reason the fans are arranged with a hinge joint immediately below the motor proper. This permits the motor with the fan to be tilted to the angle which blows the breeze in the desired direction. When adjusted at the proper angle the motor is held firmly in position by means of a wing screw. No swivel attachment is supplied, as these fans are so light it is much easier to turn them in the desired direction. The two larger sizes are somewhat heavier and are therefore provided with trunnion and swivel mountings. Both the trunnion and swivel are provided with wing screws. The 12-in. and 16-in. fans can also be furnished with an oscillating device.

The features of construction of the fans are as follows: The journal boxes are self-aligning and are lubricated by grease from wick-feed grease cups. These grease cups are accessible from the outside and will hold sufficient lubrication for a season's use. To take up the thrust of the fan a ball bearing is provided at the end of the shaft opposite the fan. This prevents any wear on the ends of the journal boxes and prolongs the life of the fan. In the base of the motor is located a four-point switch by means of which the speed of the motor can be changed at will. Three running speeds are provided for in all the motors. Great care has been taken to insure quietness of operation. The motors are balanced to prevent the vibration which might cause a humming noise to be set up in the desk or wall to which they are attached. The fan blades are shaped so that they move the air gradually and without causing eddy currents or setting up vibrations. The fans are kept in stock for 110-volt direct and 110-volt, 60-cycle alternating-current circuits. They can be wound for other voltages and frequencies, when so ordered. The stock fans will operate satisfactorily in voltages and frequencies 5 per cent above or below these figures.



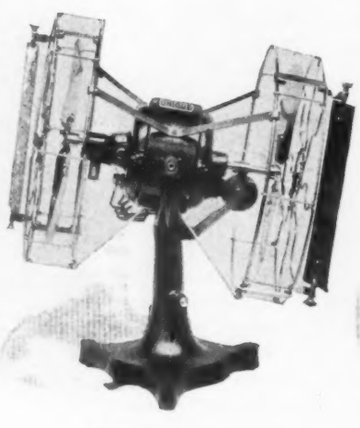
Crocker-Wheeler Fan.

FIDELITY FANS.

The Fidelity Electric Company, Lancaster, Pa., has changed its style of desk fans almost entirely this year. The company builds a combination desk and bracket fan, a swivel and trunnion desk fan, an oscillating desk fan for 110, 220 and 250-volt direct-current circuits, two types of ceiling fans for 110, 170, 220 and 250-volt circuits, and a line of 8-in. combination and socket fans for alternating and direct-current circuits. The socket motors have bipolar field magnets with a single coil, and the motor is completely inclosed in a ventilated brass casing which terminates at the rear end in a screw plug to fit the standard Edison lamp socket. The fan is driven at a speed of about 1600 r.p.m. and requires approximately 15 watts. It is wound for 110-volt direct-current circuits only, and the alternating-current fan is wound for 25, 40 and 60-cycle, 110-volt circuits. The oscillating fans in both the alternating-current and direct-current types employ mechanical means for moving the fan, including gear and worm. Both the alternating-current and direct-current fans follow standard construction.

UNIQUE DIRECT-CURRENT FANS

The direct-current desk fan marketed by the Unique Fan Company, Jersey City, N. J., has two sets of blades and revolves in a circle, this distinguishing it from the usual fans on the market. In addition, the fan while operating tilts or seesaws. This movement is obtained by setting the vanes on the guards for whatever speed is desired (one vane acting against the other), the speed at which the fan will revolve being thus under control. While the speed with which the fan will tilt cannot be increased or decreased, the amount of tilt can be regulated by a set screw on the arm of the gear. The fan is built in 12-in. and 16-in. sizes for 110-volt and 220-volt circuits. The motors are equipped with a four-point regulating switch giving three running speeds, and the bearings are self-aligning and self-oiling.



Unique Fan.

Fidelity Oscillating Fan.

CENTURY FAN MOTORS.

The line of ceiling and desk fans marketed by the Century Electric Company, St. Louis, Mo., is designed for single-phase alternating-current circuits only. The desk and wall-bracket fans are of the split-phase induction type, with cast-iron motor frame and laminated field structure. The rotor is of the well-known squirrel-cage type, and a five-point speed regulating switch is located in the base of the fan. Each fan is provided with a swivel and trunnion, the trunnion having a positive lock to hold the motor in position, consisting of several thin steel plates, half of which are fastened to the motor and the other half to the yoke, a thumb-screw clamping them together. The mechanism of the oscillating fans is high grade. The gears run in grease pockets, and speed reduction is obtained by one coarse worm gear and several spur gears, resulting in a mechanism both efficient and long-lived. The weight of the motor is carried on ball bearings, so that the friction loss, due to the turning of the fan while oscillating, is kept at a minimum. When the fan is tilted from the horizontal adjustment the air through its 120 deg. of oscillation is blown in the same plane. The ceiling fans built by the company are also of the split-phase induction type, and are all fitted with blades giving the fan a sweep of 58 in. Two or four lamp electroliers can be furnished to attach to the oil cup of the fan.

BATES ELECTRIC FANS.

The fans manufactured by the D. L. Bates & Brother Company, Dayton, Ohio, are built for direct-current circuits only, the ceiling fans being wound for 110, 167, 220, 250 and 500 volts. The power consumption of the 110-volt ceiling fan is stated to be 90 watts. The fans are provided with large and well-ventilated armatures, assembled of high-grade laminated thin-steel punchings. The coils are form-wound and slip into the slots, where they are wedged and held without banding wires, owing to the shape of the slot itself. When the armature is completed it is dipped into an insulating varnish and thoroughly baked. The field coils, which are six in number, are form-wound and have, in addition to large radiating surface, provisions for ventilation. The bearings run continually in self-oiling boxes, the lower bearing being self-aligning by the weight of the armature, thus causing it to be in line with the upper bearing and preventing uneven or noisy running of the fan. The brushes are composed of a special grade of carbon, and their contact is regulated by spiral springs. When the fans are operated with single-speed or three-speed switch attachment the revolving shaft is hollow, the switch stem extending through it and connecting to a porcelain switch pivoted to the top motor bracket. Fans without switches are equipped with solid shafts. The company's 12-in., 16-in. and 20-in. direct-current universal fans can be used with desk, trunnion or wall-bracket mountings without the use of extra adjustments. Each fan has a rheostat switch in its base giving three speeds.

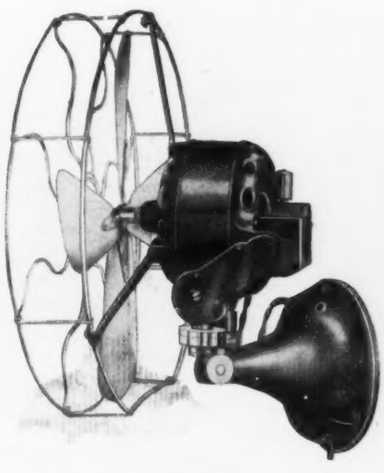
DAYTON DESK AND CEILING FANS.

The Dayton Fan & Motor Company, Dayton, Ohio, builds a line of direct-current and alternating-current desk and ceiling fans. The alternating-current fans are of the induction type and have three running speeds. The desk type is equipped with four blades and the residence type with six blades, and neither has an automatic cut-out. The ceiling fans have a sweep of 60 in. and have speeds of 225, 175 and 125 r.p.m. The line of direct-current fans is practically identical with that offered by the company during past seasons. The company's chief ceiling fan is equipped with a Gramme ring type of armature, and has three speeds, 100 r.p.m., 150 r.p.m. and 200 r.p.m. It has one oil cup and one bearing, which is kept thoroughly lubricated by the oil being worked up and down by means of a spiral groove. Other direct-current ceiling fans manufactured by the company have sweeps of 57 in., 48 in. and 32 in. and are of the single-speed drum-armature type.

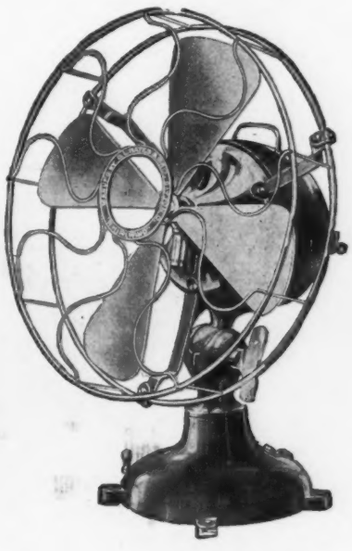
FORT WAYNE FANS.

While the past year has brought no radical changes in the Fort Wayne fans, efforts have been made to perfect in minor details the excellent fans of the past season. As usual this company is making a strong feature of its line of 8-in. fans and especial attention is called to its alternating-current fan of this size. This fan is of novel design and in service has proved itself to be thoroughly practical in operation.

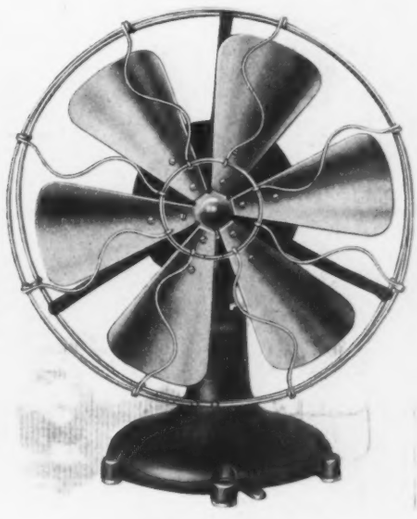
In 1901 the Fort Wayne Electric Works developed what



Century Oscillating Fan



Bates Desk Fan.



Dayton Fan Motor.

is claimed to be the first practical 8-in. fan and it was the first company to place so small a breeze distributor on the market. The company, foreseeing the present demand, stood by the 8-in. fan, improving and developing it each year until it brought it to its present state of perfection.

The fan has a drawn-metal frame, the magnetic path being of high-grade laminated iron. The construction used gives, it is said, the lightest 8-in. fan on the market, the complete fan weighing only 4 lb. The alternating-current fan is of the squirrel-cage type, but the squirrel cage revolves around the field instead of within it. This construction has the mechanical advantages afforded by a one-bearing motor, eliminates the necessity of slip-rings and other moving contacts, and makes it possible to wind the field in place on the stator by machine rather than by hand.

The field of the 8-in. alternating-current fan is of the split-phase construction and is wound with two poles, thereby securing a synchronous speed of 3600 r.p.m. and a full-load speed of 2200 r.p.m. against a full-load speed of 1600 r.p.m. in four-pole windings. The Fort Wayne fan is said to be the only one which uses this two-pole winding.

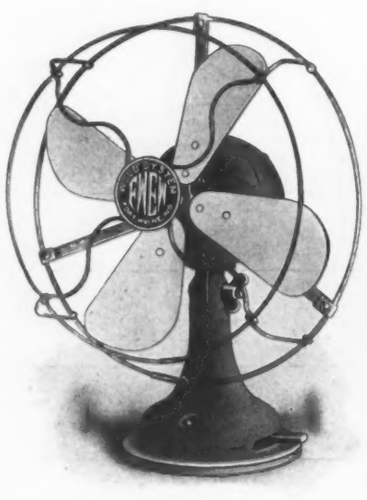
The Fort Wayne fan has three speeds, a speed control being secured by a sliding switch located in the base. On the slow speeds this switch places reactance in the electrical circuits, thereby securing the reduced speeds with scarcely any perceptible waste of power. The fan is absolutely "fool-proof" in that it may be stalled indefinitely on any point of the switch without resulting in injurious effects to the motor. The fan has no automatic cut-outs, hence a big source of trouble in many small motors is eliminated.

The Fort Wayne fans, both for alternating-current and direct-current circuits, are simple in construction, noiseless in operation, effective in service, economical in power consumption and free from defects in service. In short, they are admirably adapted to their intended service on desk or wall where they are close to the user. The line for 1912 includes fixed, oscillating, revolving, desk, bracket, ceiling, counter column and floor fans in all popular sizes and finishes for all voltages and frequencies. The main office of the Fort Wayne Electric Works of the General Electric Company is located at Fort Wayne, Ind.

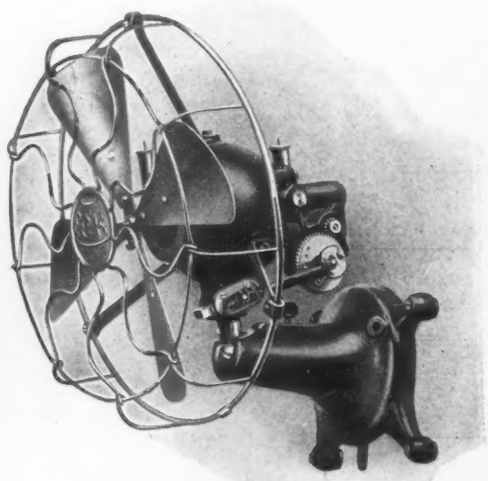
sizes, and the oscillating mechanism comprises a worm gear submerged in grease. As a protection against breakage due to prevention of oscillation, a friction disk is used in the gear frame, so that when the fan is prevented from oscillating the gears are not subjected to extraordinary strain. The latter are of the double reduction type inclosed in a gear case. The Eck hurricane universal fan can be tilted in both directions 60 deg. from the center line, and is equipped with a three-speed rheostat which will enable the motor to run continuously on the lowest speed without overheating. Except for the natural humming of the blades, the motor is said to be noiseless in operation. The rheostat handle is arranged in the front of the fan. The line is practically identical with that offered by the company for the past two years.

DIEHL OSCILLATING AND DESK FANS.

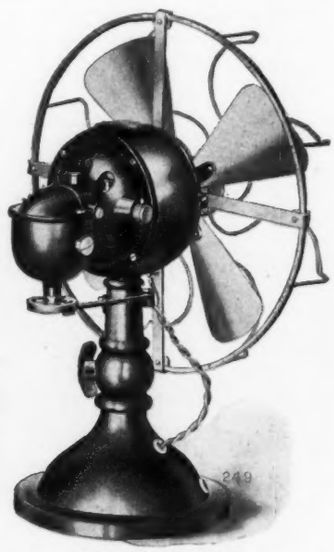
The line of fans offered for the 1912 market by the Diehl Manufacturing Company, Elizabethport, N. J., is practically the same as that offered last season, the changes being slight and having to do with mechanical details. The company has been engaged in the manufacture of fans for over twenty years, and many of the parts are made with automatic tools, insuring interchangeability. The armatures and field coils are machine-wound, and the commutators are carefully made. The oiling system is adequate, with no possibility of throwing or dropping oil, and a special resistance wire wound on plates of mica is used in the speed regulators. The company builds all sizes and types of desk fans for direct and alternating-current circuits, and direct-current ceiling fans in four and two-blade types, with and without electroliers. The Diehl oscillating fans have divided ball joints with corrugated steel washers on their faces, thus permitting adjustment to any desired angle by means of a wing screw. The oscillatory movement is obtained by means of a series of worms and bevel gears



Fort Wayne 8-in. Fan.



Eck Hurricane Oscillating Fan.



Diehl Oscillating Fan.

ECK HURRICANE FANS.

The oscillating and universal adjustable desk types of fans built by the Eck Dynamo & Motor Company, Belleville, N. J., are intended for 110-volt and 220-volt direct-current circuits only. These are built in 12-in. and 16-in. inclosed in a dust and oil-proof case affixed to the rear of the motor. The armature shaft carries a worm of comparatively large size, which with the wheel that it drives is designed with special teeth to reduce wear. The worm, which is the only part subject to wear, is readily removable from the armature shaft, and can be replaced without difficulty. The other parts of the gear run at a very slow speed and the wear on them is negligible. All of the gearing running in grease, noise from this source is nil. By means of tapped holes in the disk at the bottom of the gear case, the oscil-

latory movement may be varied from zero to a maximum of 105 deg. All of the fans are provided with regulators for three running speeds. The four-blade ceiling fans are of the iron-clad type with cartridge brush holders, so designed as to render the brushes readily accessible. The motors are designed for 115 and 230-volt circuits and for maximum speed of 210 r.p.m. The two-blade type of ceiling fan has a motor of the external ring type with flat commutator. The blades have a sweep of 60 in., and if necessary four blades with a sweep of 54 in. can be fitted to the external ring type fan. The regular four-blade fans have sweeps of 56 in.

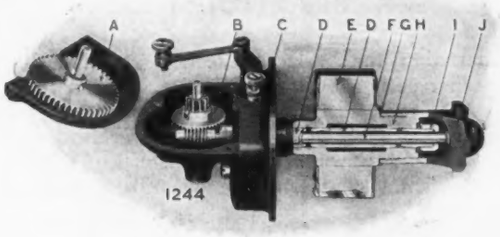


Fig. 1—Oscillating Mechanism. Emerson Fan.

EMERSON AND TROJAN FANS.

The Emerson Electric Manufacturing Company, St. Louis, Mo., has redesigned its alternating-current fans, with the exception of the 8-in. size, this year. The fans offered by this company for alternating-current circuits have motors of the induction type, and the 1912 Emerson and Trojan alternating-current motors are equipped with an improved winding on the stator and the simple squirrel-cage rotor. The improved form of winding is, in effect, a modified two-phase winding, which when used in connection with the impedance coil in the base of the fan assures highly satisfactory speed regulation. The design involves no mechanical starting device either in the stator or on the rotor. The armature of the new motor consists simply of laminations of sheet steel assembled on a cast hub, with copper conductor bars. The motors have no brushes or commutator, no moving contacts of any kind and no insulated windings on the armature. Although the mechanical starting device successfully used on Emerson and Trojan alternating-current fans for many years has been eliminated from this design, the motors start promptly on any of the three speed points when supplied with energy at the voltage and frequency for which the motor is designed.

The Emerson and Trojan oscillating fans for the season also embody these improvements, the motors carried in stock being suitable for 104 to 115-volt, 60-cycle circuits. The Emerson alternating-current desk and oscillating fans are equipped with a bearing differing essentially from that used in other desk fans. Instead of a rotating shaft of soft steel to which the armature is pinned, the shaft of the Emerson fan is a hollow steel spindle pressed firmly into the rear housing of the motor. The armature rotates upon this shaft and is entirely separate from it. A stud passes through the shaft and holds a retaining screw with washers at the front end to keep the armature in position. The armature hub is threaded at the front end to receive the fan hub, which is screwed against a leather washer, thus eliminating any possibility of oil reaching the fan blades.

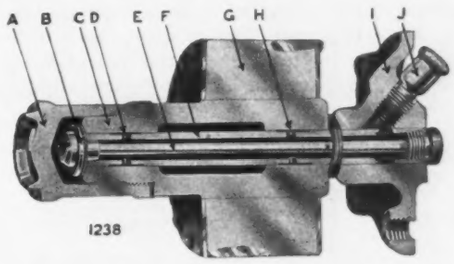


Fig. 3—Detail of Bearing. Emerson Fan.

The oscillating mechanism of the Emerson oscillating fans offered this year consists of a worm shaft with a worm engaging a worm wheel and the gear wheel inclosed at the rear of the motor. The pinion mounted on the worm wheel engages a large gear wheel, rotating the gear shaft and disk on top of the gear case. This rotating disk is connected by levers to the stationary base of the fan, causing the motor body and blades to oscillate with each movement of the disk. The worm shaft is entirely separate from the armature of the motor, and the wearing parts of the oscillating mechanism are readily renewable. The oscillators are so designed that the range may be adjusted to provide for sweeps through varying arcs up to 100 deg.

For the first time the Emerson company is offering a complete line of 8, 12 and 16-in. swivel-trunnion fans for direct-current and 12-in. and 16-in. oscillators for direct-current. The field of the 8-in. fan is of laminated iron bolted to a steel shell, to which the housings of the motor are accurately fitted. Wick-filled oil wells are inclosed in each housing directly below the bearing. The shaft is of ¼-in. steel, and the bearings are of the renewable type machined from bronze. Cartridge-type brush holders carry ¼-in. round carbon brushes, and are easily removable by loosening a set screw holding each in position. The 8-in. model has a ventilated resistance similar to that used on the 12-in. and 16-in. fans of previous seasons. Special attention has

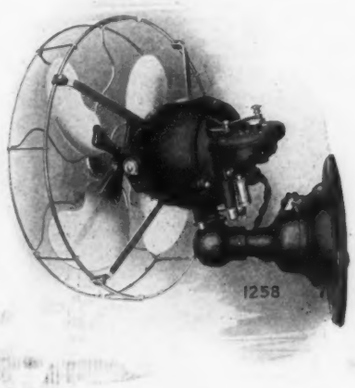


Fig. 2—Emerson Oscillating Fan.

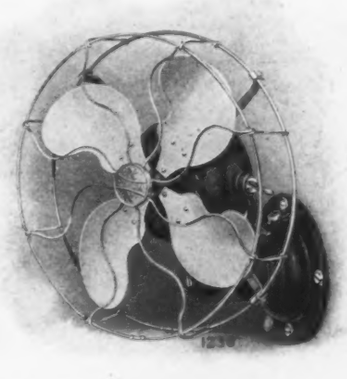


Fig. 4—Emerson Bracket Fan.

been paid in designing the frames of the direct-current motors to make the commutators readily accessible for cleaning and sandpapering. A cast shutter secured by a thumb nut may be readily removed, thus exposing the brushes and a full half of the commutator. The armatures of the Emerson direct-current fans are built of laminated punchings with coils wedged in semi-closed slots.

The Trojan alternating-current desk and oscillating fans are identical in electrical design with the improved types of Emerson fans described above, although not possessing many of the special features of the Emerson fans. The Emerson and Trojan ceiling fans are practically the same as those offered last year.

JANDUS FANS.

The Jandus fans built by the Adams-Bagnall Electric Company, Cleveland, Ohio, are manufactured in all sizes and types for general use. In addition to the line of standard desk, bracket and oscillating fans, the company manufactures the well-known "gyrofan." This is intended for ceiling use, and is made up of two desk fans seated on a bracket, which is adapted to revolve about the axis of the hanger stem, and the motors are set at such an angle that the reactive efforts of the fan cause the whole to revolve. If necessary, the bracket may be locked in any position and the fans adjusted to throw air continuously in any direction. The desk fans have motors of the spherical type, the direct-current field-magnet structure being bipolar, with form-wound magnet coils connected in series with the armature. The latter is of the usual slotted type with form-wound coils. Rectangular brushes are employed in brush holders of the cartridge type, and a rheostat in the base of the fan allows for speed regulation. The bearings are of the wick-oiling type. The alternating-current fan built by the company is very similar in appearance to the direct-current machine. Both classes of fans are provided with the swivel and trunnion mounting. The oscillating fan differs somewhat from the usual type of geared fan in that the motor is mounted with a crescent-shaped yoke by means of two hardened steel pivot pins, which protrude from the yoke and engage with top and bottom points on the motor body ring, the pin in the lower part of the yoke being provided with a ball bearing.

The actuating mechanism consists of two gear wheels, forming the simplest type of differential gear. One is stationary and the other is actuated by means of an eccentric carried by the motor shaft. The arm engaging with the groove in the crescent yoke has at its end a pin which moves up and down in the groove, and by adjusting which different angles of oscillation can be obtained, as may be thought desirable.

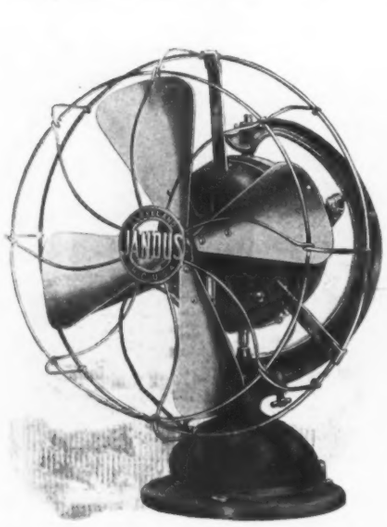


Fig. 1—Jandus Oscillating Fan.

Fig. 2—Jandus "Gyrofan."

Fig. 3—Western Electric Ceiling Fan.

WESTERN ELECTRIC FANS.

The fans of the Western Electric Company for 1912 have been redesigned, especially the 12-in. and 16-in. desk and bracket fans, 12-in. and 16-in. mechanically operated oscillating fans, and the 12-in. six-blade residence-type fan. In these types a drawn-steel frame instead of the ordinary iron frame is used. This feature, which is an innovation in the manufacture of electric fans, possesses several advantages. It affords a fan of much greater strength yet of lighter weight, the drawn-steel fans being from 20 to 40 per cent lighter than iron fans of the same types and sizes. Another advantage possessed by drawn steel over the iron frames is in the finish. The steel frame lends itself to a variety of finishes, such as statuary bronze, mottled copper, polished brass, brushed brass, nickel and other similar materials.

Fig. 1—Western Electric Oscillating Fan.

Fig. 2—Western Electric Desk Fan.

The graceful lines and harmonious appearance of these fan motors can be readily appreciated from the accompanying illustrations. In addition to the drawn-steel types of fans, the Western Electric Company has added to its already complete line a new 32-in. alternating-current ceiling fan, which is furnished in black enamel, white enamel and mottled copper.

MANHATTAN ELECTRICAL SUPPLY COMPANY'S FANS.

The Manhattan Electrical Supply Company, New York, builds a number of fan motors, known as the Mesco, the Mesco Junior and the Ideal, the last being intended for use with primary batteries, and the second being built for primary-battery and for commercial lighting circuits. The 12-in. and 16-in. desk and wall-bracket type of Mesco fan is designed for 110-volt and 220-volt circuits and for speeds approximating 900, 1400 and 1800 r.p.m. The motors are equipped with laminated armatures and form-wound field coils, with mica-insulated commutators, self-adjusting cartridge-type brushes and wick-type oil cups. The Mesco Junior direct-current fan for 110-volt and 220-volt circuits is built in the 8-in. size only and is supplied with a knuckle joint so as to permit the fan body to be moved in a vertical plane. A controlling switch in the base is arranged to give speeds approximating 1000, 1500 and 1900 r.p.m. The battery Mesco Junior fan outfit comprises an 8-in. fan and 12 cells of dry battery connected in multiple series. The Ideal motor is equipped with a 9-in. fan, and is intended for use in connection with the Edison primary battery or with dry cells connected in multiple series.

WESCO DESK FANS FOR ALTERNATING CURRENT.

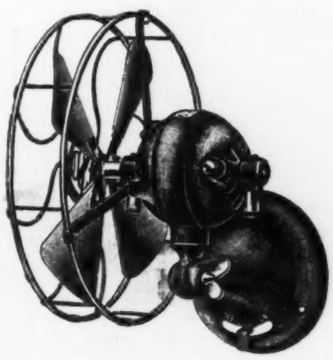
The 8-in. desk fans offered by the Wesco Supply Company, St. Louis, Mo., for the season of 1912 are the same attractive brushed-brass-finish, hinged-type, drawn-steel motors furnished during the season of 1911. They are three-speed induction fans without mechanical starting device. All types of Wesco fans have blades of the conventional shape and all Wesco desk fans have bronze bearings and rotating steel shaft. The Wesco 12-in. and 16-in. swivel-trunnion fans for the season of 1912 are new three-speed models without mechanical starting device. These fans have many features, including the convertible bracket base, which permits any desk fan to be used as a bracket fan without extra parts.

The Wesco 1912 model oscillating fans are also three-speed induction motors of improved appearance and operating qualities. These motors are of the hinged type and have adjustable base, giving the trunnion effect and also permitting the motors to be used as bracket fans without interfering with the oscillating function of the fan. The oscillators are mechanically operated and certain in their oscillating movement. Four ranges of oscillation may be secured, as well as a stationary position if it is desired to use the fan without the oscillating movement. The Wesco desk and oscillating fans are claimed to be efficient, reliable and satisfactory and the equal of any similar apparatus on the market.

PEERLESS FANS.

The Peerless Electric Company, Warren, Ohio, manufactures a line of 8-in., 12-in. and 16-in. alternating-current and direct-current desk and oscillating fans, in addition to two types of direct-current ceiling fans, one type of direct-current column fan and direct-current and alternating-current ventilating fans. The line is similar to that offered last year. The alternating-current fans are of the single-phase self-starting type, with swivel and trunnion adjustment, and designed for two speeds, although the small 8-in. fan has a three-speed switch. The oscillating mechanism in both the alternating-current and direct-current fans is identical. The worm gear which accomplishes the oscillation travels in a dust-proof case full of lubricant, and the mechanism can be disconnected by shifting a thumb-screw. One hundred and ten degrees is the scope of oscillation, but this may be reduced by changing a single adjustment. The oscillating fan is carried on ball bearings and has a three-speed switch and extra stiff guards and braces. The ceiling and column fans have a maximum speed of 220 r.p.m. The standard fans are equipped with four blades and have a sweep of 56 in. and a three-blade switch rendering speeds of 110 r.p.m., 170 r.p.m. and 220 r.p.m. available. No switches are furnished on the 170, 250 and 500-volt fans. All styles of direct-current fans have commutators made of hard-drawn Lake Superior copper segments with best mica insulation. The fans are equipped with solid brass blades and guards, self-aligning bearings, inclosed by a hood so as to preclude oil throwing, rectangular brushes of liberal cross-section and brush holders which allow of easy adjustment and renewal of the brushes.

Peerless Desk Fan.



Manhattan Bracket Fan.

Fig. 1—Wesco Desk Fan.

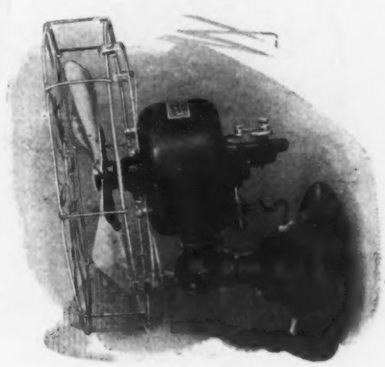


Fig. 2—Wesco Oscillating Fan.

COLONIAL DESK AND CEILING FANS.

The alternating-current and direct-current desk and ceiling fans of the Colonial Fan & Motor Company, Warren, Ohio, have undergone modifications in design since last season. The 8-in. universal fan will be equipped with improved brush holders and with brushes made especially for the fan. The alternating-current motor of this size is of the commutator series-wound type following the same general construction as that of the 12-in. and 16-in. fans. The 12-in. and 16-in. fans in both alternating-current and direct-current types will be the same in construction as those of last season, the direct-current fans having three speeds and a cut-out and the alternating-current fan having two speeds and a cut-out; but the variation between the first and second speeds will be greater than that of last year's fans. The oscillating fan, which is equipped with the universal joint, will be of the worm-gear type, but will oscillate only one-half as fast as the fan of last season, with the result that it will be smoother in operation and more nearly noiseless. The direct-current ceiling fans will be made as in the past in the plain and ornamental designs without change. The oscillating fan offered by the Colonial company has a mechanical drive as distinguished from a vane. The oscillating device consists of a worm-gear attachment placed immediately behind the blades and not behind the motor. The gears run in oil, and by changing a thumb-screw on the bottom of the oscillating device any desired degree of oscillation within the scope of the machine can be obtained. The alternating-current fans are built for 60-cycle circuits of standard voltages.

KIMBLE REVERSIBLE ALTERNATING-CURRENT FANS.

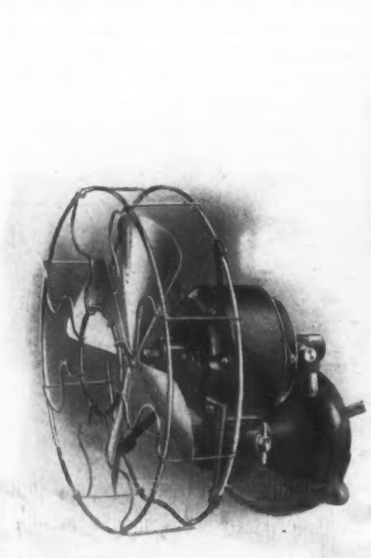
The Kimble Electric Company, Chicago, announces that it has added to its line for 1912 a new 42-in. ventilating fan. This fan is driven by a 2-hp, single-phase, variable-speed, reversible alternating-current motor. Its maximum speed is 550 r.p.m., at which speed the manufacturer claims it will move 22,000 cu. ft. of air per minute.

The distinctive feature of Kimble fans is the fact that the motor is instantly reversible from any speed forward to any speed in the opposite direction, and that the power consumed is at all times in approximate proportion to the speed of operation. Its variation of speed in either direction is not by steps, but gradual and imperceptible. But perhaps the most striking feature of the 1912 Kimble fan motors is the fact that they will be built, if desired, with outside transformer controller, instead of the lever and chain control as formerly. This change was made in order to secure a power-factor of from 90 to 97 per cent.

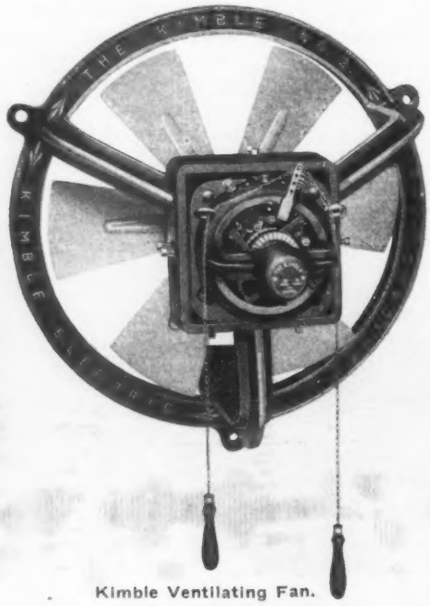
The Kimble fan is built regularly with straight aluminum blades instead of the involuted type of blade, in order that the user may realize the full air moving efficiency, whether he operate the fan for intake or exhaust. A feature of the Kimble alternating-current fan is the low starting current that it requires, making it feasible for installation on lighting circuits. For instance, it is claimed that the 36-in. straight-blade fan driven by a 1½-hp motor, moving 17,300 cu. ft. of air per minute at 550 r.p.m., starts on 4 amp, runs full speed on 8 amp, and reverses from full speed forward to full speed backward on 9 amp. The increasing demand for Kimble fans and motors, it is said, has necessitated several successive enlargements in the Kimble plant at 1127 Washington Boulevard, Chicago.

HUNTER FAN MOTORS.

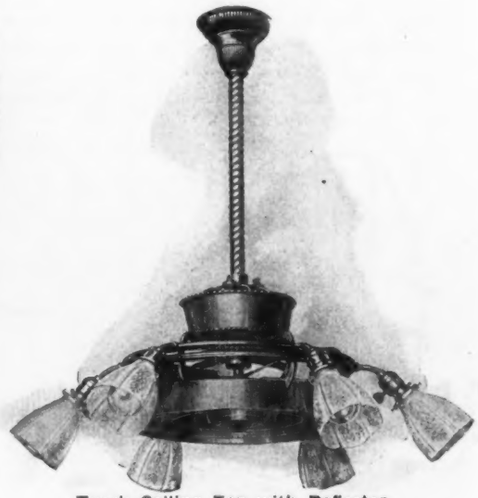
The "Tuerk" and "H E" alternating-current and direct-current ceiling and desk fans manufactured by the Hunter Fan & Motor Company, Fulton, N. Y., are built in all sizes and styles for all standard voltages and frequencies. Five types of Tuerk alternating-current ceiling fans are offered, six types of desk fans, two types of direct-current ceiling fans and two types of ventilating outfits. One type of ceiling fan is designed for high frequencies ranging from 50 to 140 cycles and for voltages ranging from 50 to 220, while another type is made up of a slow-speed induction motor particularly adapted for frequencies of 25, 40, 50 and 60 cycles. The latter is the regular standard fan of the company. It is furnished with a two-speed regulating switch, has four blades, a sweep of 52 in. and operates at a speed of 225 r.p.m. A deflector ceiling fan, made for both direct-current and alternating-current circuits, is unique in ceiling fan work. It has five speeds and is equipped with four steel blades on the inside of the case, the sweep being 14 in. and the speed ranging from 500 to 1050 r.p.m. The stationary deflectors give an even distribution of air, and the fan is offered for use in places where the usual type of paddle fan would be objectionable. The alternating-current desk fans are designed for frequencies



Colonial Bracket Fan.



Kimble Ventilating Fan.



Tuerk Ceiling Fan with Deflector.

ranging from 25 to 133 cycles. The motors are of the high-speed single-phase type, wound for voltages ranging from 110 to 220, and are equipped with switches providing three running speeds. The oscillating fan is operated through gears direct-connected to the rotor shaft, and the range of oscillation is adjustable. The direct-current fans are of the standard type, and the direct-current ceiling fans are furnished with either two or four blades and operated at a maximum speed of 220 r.p.m.

ROBBINS & MYERS FANS.

The Robbins & Myers Company, Springfield, Ohio, is offering for the season of 1912 a complete line of alternating-current and direct-current ceiling, desk and oscillating fan motors, designed for all standard voltages and frequencies. The line includes 8-in., 12-in. and 16-in. alternating-current and direct-current desk and wall-bracket type of fans, 12-in. and 16-in. alternating-current and direct-current oscillating fans, 12-in. and 16-in. alternating-current and direct-current exhaust fans, and the well-known line of direct-current ceiling fans with the addition of the style E ornamental and the style F plain types of alternating-current ceiling fans.

Attention is called to the alternating-current model 14 desk and the model 11 oscillating fans which employ a special form of winding, eliminating the troublesome centrifugal switch and the resulting burn-outs of the starting winding when this switch fails to operate. This form of winding was thoroughly tried out last season on the model 14 and proved very popular. This winding in connection with the special method of riveting the field punchings results in a very quiet-running fan. The model 11 geared-type oscillator, which is again offered for this season, is furnished for both direct and alternating current. The reduction mechanism consists of a double worm and wheel train inclosed in an oil-proof box and moving the fan from side to side by crank disk and pitman operating in a horizontal plane. This pitman or connecting rod swings at one end upon a hardened-steel stud fastened to a stationary support, and at the other end upon a crank pin adjustable to and from the center of the crank disk for the purpose of regulating the angle of oscillation. This construction practically eliminates the wear at these points and is a matter of very great importance, as any lost motion in the ends of the connection rod will at once result in unsteady movement at both ends of the swing.

The fan is universal in its adaptability. The ball-bearing spindle on which the motor turns from side to side is mounted in a joint in the top of the base, which allows it to be adjusted to any proper range or elevation and to be instantly converted from desk to wall-bracket type or vice versa. A number of properly spaced counter-sinks in the swinging joint provided for seating the screw which is in the side of the base secure this adjustment. The fan can readily be made stationary by removing the crank pin, allowing the connecting rod to remain free; then, after turning the motor in the direction desired, set up the wing screw in the swinging joint until it is tight. This will hold the fan permanently in that position as a stationary desk fan.

The styles E and F alternating-current ceiling fans employ the same type of winding as the alternating-current desk fans. The motors are strongly constructed throughout, very durable and practically noiseless. The fan blades are mounted on a spider directly beneath the motor, which gives the benefit of the full sweep. This gives an unusual amount of air displacement as compared with fans which have the blades fastened to the outer shell of the motor or to long blade-carrier projections.

WESTINGHOUSE STEEL-FRAME FAN MOTORS.

The Westinghouse Electric & Manufacturing Company has brought out this year a complete new line of fan motors with steel frames instead of the usual cast-iron construction. The motor frame, the base and the guard arms are made of drawn steel, thus combining great strength with minimum weight, the fans weighing from 20 to 40 per cent less than cast-iron frame motors of corresponding sizes. The steel is drawn into graceful, harmonious lines and the standard finishes are black enamel and black oxide, similar to gun metal.

A feature of the motors is the swivel-and-hinge joint which connects the motor and the base. By means of this joint the fan can be tilted within 105 deg. or rotated within 340 deg. in any direction and can be changed from desk to bracket mounting by means of a wing nut without the use of a trunnion, tools or an adapter. All 25-30, 50 and 60 cycle motors have three speeds controlled by a lever in the base of the fan which is firmly held at each running point and does not open the circuit between points.

The motors are of new design and have been made very efficient, showing an unusually low power consumption for the amount of air moved. This has been accomplished without sacrificing the air output. The laminations are securely riveted together and are pressed into the motor frame. The single starting winding and the centrifugal cut-out switch are used as the best possible means of starting, thereby eliminating probable burnouts, decreasing power consumption and giving more starting torque. The fan blades are of standard design so shaped as to move the maximum amount of air with minimum noise and least expenditure of power.

Series-wound motors are used for 25-30 cycle fans on account of their higher efficiencies for this frequency range and also because of the greater torque. Series motors also permit higher speeds on this frequency, thus delivering

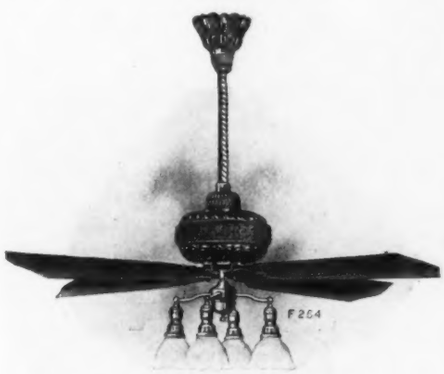


Fig. 1—Robbins & Myers Ceiling Fan.

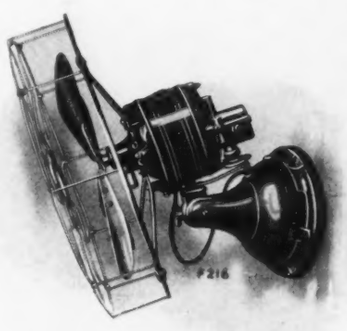


Fig. 2—Robbins & Myers Oscillating Fan.

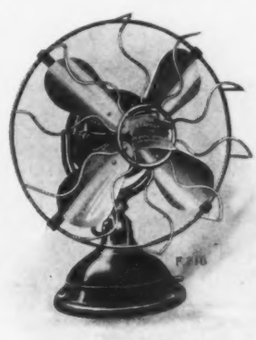


Fig. 3—Robbins & Myers Desk Fan.

more air. Imported brushes of large area and the very best quality are used. The fans have a heavy felt base, which is firmly clamped in place, similar to the base of a desk telephone.

The residence fan motors are practically noiseless in operation. They have six blades and the motors are wound for slow speed. They are built in three types, desk-and-bracket, mechanically operated oscillating, and air-operated oscillating.

A new line of mechanically operated oscillating fan motors in drawn-steel frames, a further development of the desk and bracket line, will be offered this season. In these fan motors the oscillating mechanism is entirely inclosed and can be stopped and started while the fan is in motion.

Mechanically operated oscillating fan motors in cast-iron frames of the design so successful last season are again offered. The gears of the oscillating mechanism operate in a closed case packed with grease and require lubrication once a season only. The arc of oscillation can be made 45 deg. or 90 deg., or the oscillating movement can be stopped altogether if desired.

The air-operated oscillating fan motors offered this year are an improvement over last year's models. The oscillating movement is effected by means of vanes mounted in front of the fan guard. The arc of oscillation can be varied from 30 deg. to 360 deg., in steps of 30 deg. The current is carried from the base to the motor through slip-rings so that there are no leads to be broken.

Fig. 1—Westinghouse Ceiling Fan.

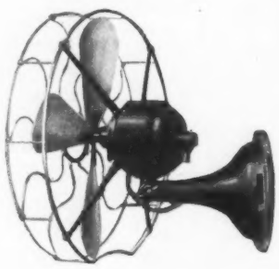


Fig. 2—Westinghouse Bracket Fan.

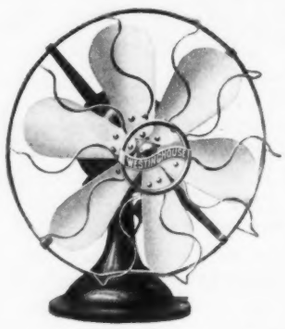


Fig. 3—Westinghouse "Residence Type" Fan.

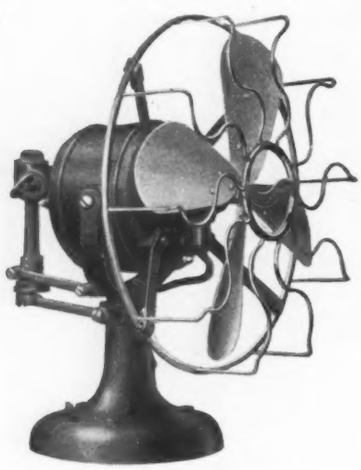


Fig. 4—Westinghouse Oscillating Fan.

Fig. 5—Westinghouse Swivel and Hinge Joint.

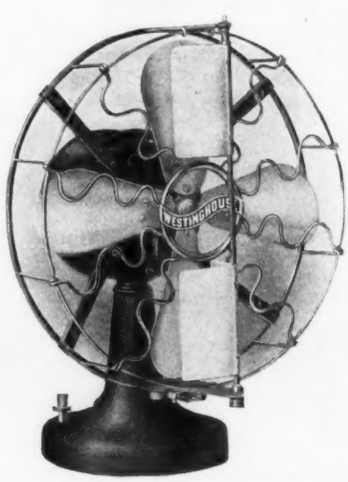


Fig. 6—Westinghouse Oscillating Fan.

The Westinghouse line for 1912 includes fan motors for every purpose and for every commercial circuit on which fan motors are used. It comprises 8-in., 12-in. and 16-in. desk-and-bracket, 12-in. and 16-in. mechanically operated oscillating, 12-in. and 16-in. air-operated oscillating, 12-in. residence, 8-in. telephone booth, long-sweep and 32-in. ceiling, counter column and floor column, and 12-in. and 16-in. exhaust or ventilating fan motors.

The 8-in. fan is of drawn brass, the same construction that has been so successfully used with this type for several years past. It possesses light weight and an attractive appearance and may be finished in black oxide (standard), mottled copper, polished brass or brushed brass. The blades are of large area, which with well-proportioned speeds give a maximum amount of air with minimum input. These fan motors are made in two types—desk-and-bracket and telephone-booth—the former having a hinged joint by means of which it can be adjusted through a wide angle without aid of tools or adapter. It is supplied with a felt base.

The line of ceiling fans has been extended by the addition of an alternating-current fan motor with a 32-in. sweep designed on the same lines as the larger ones already on the market and particularly adapted to small offices, hallways and bedrooms. The 32-in. type is furnished in two speeds in the mottled-copper finish and single speed in white and black enamel finishes. A pull switch mounted outside of motor is operated by a cord hanging within easy reach. The fan has four blades of aluminum with frosted finish.

The rotor of external type used in Westinghouse alternating-current ceiling and column fan motors represents the maximum simplicity in design and lightness in weight, with highest efficiency. The 56-in. sweep fans have four blades and are made with ball bearings immersed in oil with a pumping action obtained through operation.

The direct-current ceiling fans are furnished in small and large sweeps with white and black enameled finishes for the 32-in. and mottled copper and black japan for the 57-in. and 54-in. types. Counter and floor column fans for both alternating-current and direct-current circuits are supplied in large sweeps corresponding to the respective

ceiling types, and are particularly adaptable to certain applications where ceiling fans are not desirable. Both ceiling and column fan motors can be supplied with electrolier attachments. The lamps are located below the blades so that no unpleasant shadows are cast, as is likely to be the case with the opposite arrangement.

The exhaust or ventilating fan motors of last year are offered for this season without important changes. They are made in both 12-in. and 16-in. sizes and with Westinghouse or Blackman blades. Speed regulators can be supplied for most of the exhaust motors so that adjustment of the amount of air moved can be obtained in accordance with the desire of the owner.

SPRAGUE ELECTRIC FANS.

The Lundell fans, manufactured by the Sprague Electric Works of the General Electric Company, New York City, are among the best known on the market, and the line is again offered without important change, except that the brush holder has been improved this year in 12-in. and 16-in. desk fans. As is well known, the Lundell motor is characterized by a concentric field coil. The oscillating fan has a worm-gear mechanism, entirely inclosed within a dust-proof casing, and the mechanism is controlled by an indicator knob mounted at the rear of the gear casing. It consists of four parts, the box containing the gear, the worm, the link and the dummy set screw. The oscillating four-blade ceiling and column fans are made with improved brush holders and the well-known single field coil Lundell motors. The self-feeding oil cups are provided with a wick guide to overcome the liability of the bearings running hot.

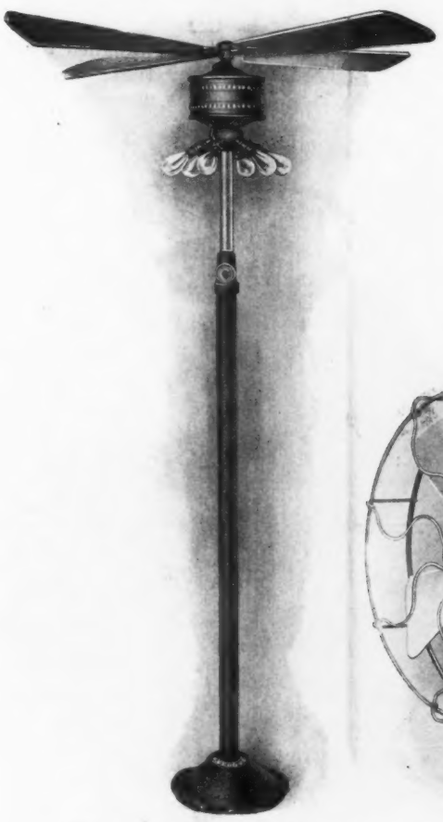


Fig. 1—Sprague Direct-Current Floor Column Fan.

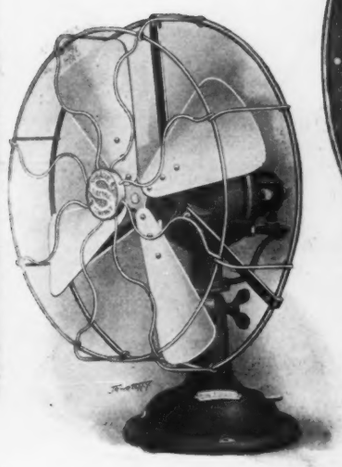


Fig. 2—Sprague Desk Fan.

movement afforded is approximately 100 deg., while the deflection downward as a bracket fan is approximately 100 deg., and as a desk fan approximately 25 deg. The fans are built in all standard sizes and for standard voltages, with three running speeds. The line of ceiling and column fans is the same as that marketed last year. The 56-in.,

ILG VENTILATING FANS.

While experience has shown that open-type motors are not entirely satisfactory for exhaust-fan purposes, owing to the collection of dust and other foreign matter in the motor, yet an inclosed non-ventilated type of motor does not have the same efficiency as the open type, owing to the consequent overheating of the armature and field coils. In the ventilating fan marketed by the Ilg Electric Ventilating Company, Chicago, Ill., an inclosed-type motor is employed, and the ventilation of the motor is accomplished by the vacuum created in the front of the center or axis of the fan, drawing air from outside through a tube connecting with the hood, which completely incloses the motor on all sides but the front. After passing around and through the motor windings, the air thus drawn in is carried away with the general exhaust. Fans of this type are built in every size for all speed voltages and frequencies.

Variable-speed controllers are supplied with every direct-current fan from 20 in. upward, and these give speed reductions of approximately 50 per cent by intermediate steps. A small regulator is furnished with 18-in. bracket fans, which serves to start and stop as well as regulate the speed of the machine. Both motor bearings, from the 20-in. to the 72-in. direct-current fans, are uniformly oiled from one point. The wheel is made from steel spokes and rims electrically welded, with blades stamped through templet. The hub is bored and reamed so as to give a wheel perfectly true and one which will run without vibration. Inasmuch as the motor is machined circular to templet, it is possible to install the motor and frame separately without disturbing the alignment.

Ilg Self-Cooled Ventilating Fan.

GENERAL ELECTRIC FANS

The General Electric line of fans for 1912 covers both desk and oscillating types in the 8-in., 12-in. and 16-in. sizes, direct current and all frequencies alternating current; but the 8-in. fan is not furnished for frequencies above 60 cycles. The standard voltages are carried in stock, and odd voltages up to 250 may be furnished on order in any rating.

This line of motors follows in appearance and general features of construction the models of the preceding year. In many important details, however, refinements in design have been incorporated. The entire line of fans for 1912 have self-aligning ball-seated bearings with ample wick lubrication and definite oil deflectors and passages for the return of grease from the shaft to the grease cup. The attachment of the base plate has been improved in that it is held on by one screw and the fiber-insulating plate is reinforced by a thin steel plate. All sizes and frequencies of alternating-current motors are of the induction type and are furnished with a resistance-reactance type of winding, having an extra resistance wound in one phase of the field circuit and external reactance in another phase. This when left in circuit gives an efficient winding and a flexible torque speed characteristic, permitting control of the motors to a very low speed while still obtaining first-class starting characteristics without any centrifugal switch or change in connection between starting and running conditions. This feature has been used in the main from two to three years, but only during the past year has the proportion of windings been worked out to perfection so as to give the very best results.

The oscillating motors have a positive oscillating mechanism with worm and gear speed reduction, using accurate die cast parts for the framework. In the main features these are duplicates of the mechanism used last season. Detail changes have been made, however, in the construction of the various bearings on the oscillating mechanism so that the dripping of oil or grease is prevented, or wherever this is impossible a chamber is provided for catching and storing the drip. The 12-in. and 16-in. oscillators have two angles of oscillation and a simple gear change device which will give either the oscillating position, a locked position or a free position of the fan body. The 8-in. motor may be varied in width of oscillation from zero to the maximum.

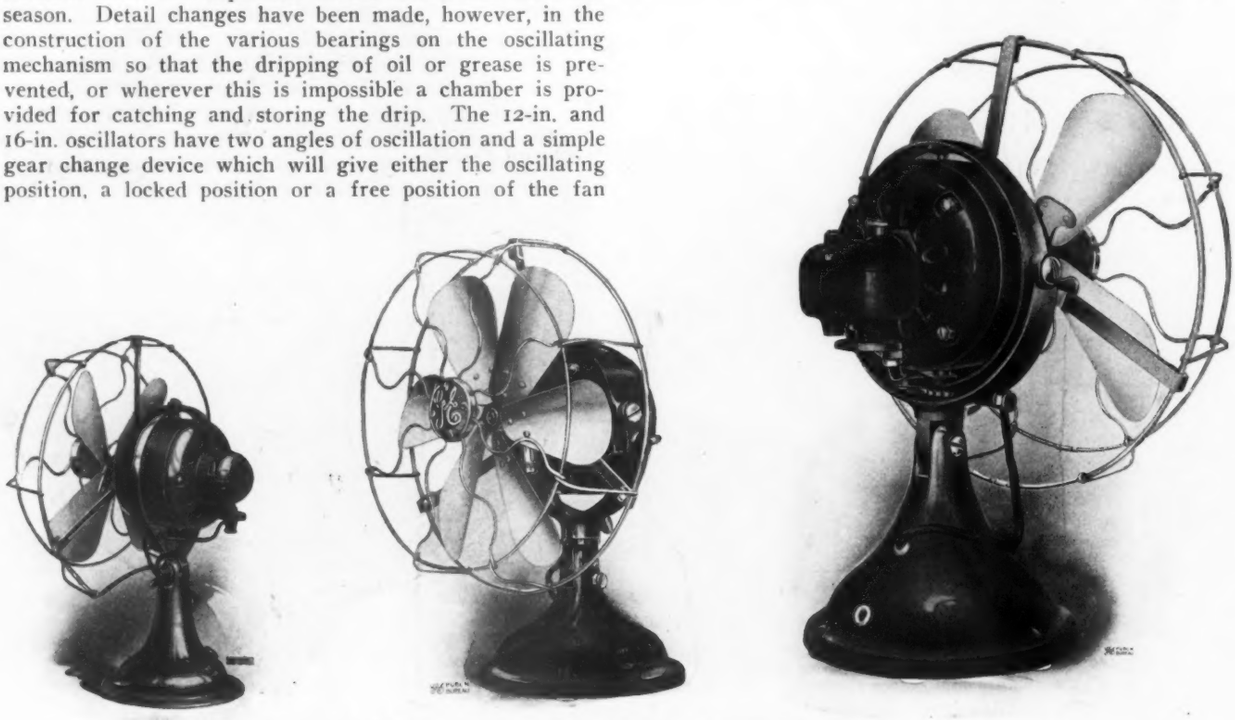
The telephone-booth type of fan is suspended from a bracket by springs, thus preventing the fan from affecting the operation of the telephone. The bracket arm to which the springs are attached is fastened to its base by a hinged joint, by means of which the fan may be inclined to an angle of several degrees from the horizontal.

The 12-in. six-blade residence fans are especially designed for use where a quiet-running fan giving a moderate breeze is desired. The 12-in. and 16-in., four-blade fans deliver a stronger breeze than the residence fans, and are for service in large offices, stores and public places. The motors are provided with switches which permit three speeds, thus providing regulation for all purposes.

The ceiling fans can be furnished in plain or ornamental designs and with electrolier fixtures if desired, as all ceiling fans are wired for lamps. The alternating-current ceiling and column fan motors are designed for operation on 25, 40, 50 and 60-cycle circuits. The plain type have two speeds while the ornamental have three running speeds. The direct-current ceiling and column fan motors are designed for 110-volt and 220-volt circuits, the plain type being designed for one speed only, while the ornamental type are designed for single and three speeds.

KNAPP BATTERY FAN.

The battery motor built by the Knapp Electric & Novelty Company, New York City, is the same as last season's, and forms a convenient portable outfit for the home or office where central-station energy is not available. The armature of the motor is of the laminated six-pole drum type, and the brushes are equipped with spring adjustment. The base of the fan is fitted with a rheostat and starting switch, the speed at 6 volts with from 8 to 10 amp passing, being 1500 r.p.m. The motor is designed for operation from a 6-volt storage battery, or from twenty dry cells connected five in series, four series groups being connected in multiple. The manufacturer states that if operated three hours a day such an arrangement will suffice for over 200 hours' operation. The company is experimenting with a 110-volt fan, but the work has not progressed sufficiently for it to offer information regarding it at this time.



General Electric Residence Type and Oscillating Fans.

Industrial and Commercial News

FIGURES issued this week by the government on imports and exports in January and the seven months ended Jan. 31 show a gain of nearly $60,000,000 in the trade balance for the seven months. In January there was a gain of $582,000 in imports over the corresponding figures in January, 1911, but there was a decrease of nearly $10,600,000 in imports in the seven months named above. Exports in January of this year were $5,374,000 in excess of those in January, 1911, and in the seven months ended Jan. 31, 1912, the export total was $49,400,000 in excess of that in the corresponding period of the previous year. Trade conditions in the week just closing have been as favorable as could be expected in view of the political handicaps that are retarding business expansion. There has been no noteworthy change in the volume of business transacted, as the narrow gains in some industries have been offset by corresponding decreases in other lines. In the greater part of the country business is reported as largely of routine nature, with minor variations, favorable or unfavorable, resulting from local conditions. Rates in the New York money market Feb. 28 were: Call, 2@2½ per cent; ninety days, 2⅝@3 per cent.

THE COPPER MARKET.

Judging merely from surface conditions, the copper market has experienced an increase in activity during the week. Moderate orders for March, April and May deliveries have been placed for electrolytic by domestic consumers, and export orders have been placed in fair amounts. Prices have been advanced slightly, and all of the selling agencies are now quoting electrolytic at 14½ cents per pound. Close observers of the market are still of the opinion that no large contracts are forthcoming from domestic consumers. These, it is believed, are well stocked for immediate requirements, and the scattered buying at present is attributed to a few consumers who had not looked far enough ahead in making their purchases. As is customary whenever consumers show a slight disposition to enter the market, there are rumors of further advances in price, but until satisfactory proof is given of the low stocks said to be in the hands of producers, there is small likelihood that these forecasts will receive serious attention. There are many in the copper trade who venture to say that recent shrinkages reported in surplus stocks are due in a large degree to curtailment of refinery output, and that large amounts of unrefined copper are accumulating. If this is the case, as it seems to be, price movements will continue to be of small import to prospective purchasers for some time to come. Exports for the month, including Feb. 28, aggregate 30,930 tons. The daily call on the Metal Exchange Feb. 28 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	14.10	14.20	.....
February	14.10	14.20	14.15
March	14.12½	14.25	14.20
April	14.20	14.30	14.25
May	14.20	14.35	14.27½
June	14.20	14.35	14.27½

The London market, Feb. 28, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	64 7 6	64 7 6
Standard copper, futures	65 1 3	65 1 3

Price extremes in 1912:

	Highest.	Lowest.
Standard	14.15c	13.75c
London, spot	£64 8 9	£60 16 3
London, futures	65 2 6	61 10 0
Best selected	68 5 0	65 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

Flaming-Arc-Lamp Installations.—Among recent orders received by the Stave Electric Company, 131 Hudson Street, New York, is one from the Delaware & Hudson Railroad Company, which will install 150 long-burning flaming-arc lamps for illumination of its shops and yards. The city of Kansas City is now installing 450 of these lamps, to be operated from constant current transformers of 100-light capacity each, and is contemplating an increase of this number to approximately 600 lamps. Another recent installation was that made by the Haskell Barker Car Company, of Michigan City, Ill., which consisted of 150 lamps. Tests made by the city of Chicago upon 250 Stave lamps and 250 flaming arcs developed by the General Electric Company with a view to determining which make will be made the basis of an order for 4000 lamps, as noted in these columns July 29, have been brought to a close, but contracts have not been placed for the rest of the installation, and it is not known which make of lamp will be selected.

Bell Telephone Company of Pennsylvania Elections.—The following were elected directors of the Bell Telephone Company of Pennsylvania at the annual meeting of the stockholders: U. N. Bethell, chairman; F. H. Bethell, J. J. Donnell, J. E. Mitchel, F. B. Reeves, T. J. Shryock, O. J. Bell, T. E. Cornish, R. M. Elliott, Richard O'Brien, A P. Perley, H. A. Richardson, W. B. Schiller, P. L. Spaulding, D L. Wilson. Officers were elected as follows: F. H. Bethell, president; H. F. Thurber, vice-president; P. L. Spaulding, second vice-president and general manager; W. S. Pierson, secretary; Ford Huntington, treasurer. The income account for the year ended Dec. 31, 1911, showed gross earnings of $19,862,382; net earnings of $4,928,861, and a surplus after dividends of $1,092,841, which is an increase of $353,605 over the corresponding item in the previous year.

Aluminum Notes and Prices.—Discussion of the affairs of the Aluminum Company of America took place on Feb. 27 in Washington, D. C., between A. V. Davis, president of the company, G. B. Gordon, its general counsel, and Assistant Attorney-General Fowler. It is stated that officials of the company offered to compromise the anti-trust suit against them by voluntary dissolution. In case this plan is approved by the Department of Justice, a friendly dissolution suit will be brought at Pittsburgh, and the company will act in accordance with the court's decree. Demand for aluminum continues moderate, and prices are steady. Quotations Feb. 27 were 19@20 cents for large ingots for remelting, 31 cents for rods and wire, and 33 cents for sheets.

Kentucky Public Utilities Company Improving Its Holdings.—The Kentucky Public Utilities Company, of Louisville, Ky., which was recently formed to take over public-service properties in Frankfort, Owensboro, Bowling Green, Hopkinsville and other Kentucky cities, has commenced improvement of its newly acquired holdings. The company has awarded a contract to the Henry Vogt Machine Company, of Louisville, for the installation of a 30-hp water-tube boiler in the power plant of the Bowling Green Railway & Light Company, Bowling Green, Ky.

Canadian Telephone Extensions Planned.—According to advices from Winnipeg $2,000,000 will be spent this year on telephone construction in Alberta. The improvements for which this expenditure will be made include construction of over 3,000 miles of rural lines, 500 miles of long-distance lines over new routes along recently constructed railways, a number of new town exchanges, and about 700 miles of additional circuits on existing long distance routes, together with improvements to a number of existing exchanges.

New York Edison Building Loan Association.—With a view to encouraging employees to save their earnings and to build homes, the New York Edison Building Loan Association has been organized with Mr. Arthur Williams, general inspector and general agent of the New York Edison Company, as its president. Committees are now at work arranging necessary details, and it is expected that everything will be in readiness for the new welfare plan to become operative early in March.

Catalogues Wanted.—D. Drury & Company, engineers and machine tool importers, Central House, Johannesburg, South Africa, are desirous of securing sole agencies for South Africa of American electrical machinery and engineering specialties.

Annual Meeting of Kentucky Electric Company.—The annual meeting of the stockholders of the Kentucky Electric Company, of Louisville, Ky., has been held for 1912 and the company is preparing to push its work along in the new year as it has in the one past. Former directors and officers were re-elected as follows: Directors: Louis Seelbach, Fred Levy, Anthony J. Carroll, James G. Kirwan, Charles J. Doherty, Lawrence Jones, R. Baylor Hickman, James A. Shuttleworth, Donald McDonald, Matt O'Doherty, Robert E. Hughes and William J. Maloney. Officers: President, Robert E. Hughes; first vice-president, Lawrence Jones; second vice-president, Charles J. Doherty; secretary and treasurer, Fred G. Speidel; chief engineer, Louis S. Streng, and general counsel, Anthony J. Carroll. The report of President Hughes to the stockholders indicates that there has been a healthy increase in the company's earnings during the past year, and that extensive improvements in its properties have been completed, with the addition to the Kentucky Electric Company's plant almost completed and important extensions in the company's lines made in suburban districts.

Tokio Municipal Bond Sale.—The $45,000,000 city of Tokio 5 per cent bonds mentioned in these columns Feb. 24, the proceeds of which will be used for acquisition of electric lighting, power and traction properties now operated in that city by private interests, have been very favorably received by investors in New York and Paris, but met with a setback in London. This was due, it is understood, from concern in London financial circles over the possibility of a general strike of mine workers. Of the $15,870,000 English allotment, underwriters were obliged to take over half. The Paris allotment, $20,000,000, was seven times oversubscribed, and while New York results have not been made public as we go to press, it is intimated that the bonds were well received, considering the present state of the bond market.

Public Service Corporation of New Jersey Orders Equipment.—The Public Service Corporation of New Jersey has placed orders with the General Electric Company for one 9000-kw, 13,200-volt, three-phase, twenty-five-cycle turbo-generator, three 2000-kw, twenty-five-cycle rotaries, two 1000-kw, sixty-cycle rotaries, and a miscellaneous equipment of transformers, automatic regulators, etc. It has also ordered one 2500-kva, 11,000-volt, sixty-cycle turbo-generator and one 1000-kw, sixty-cycle rotary from the Westinghouse Electric & Manufacturing Company.

Electric Bond Deposit Company Chartered.—In accordance with the plans of H. L. Doherty & Company, described in these columns in the previous issue, for financing the 15,000-hp hydroelectric plant of the Ozark Power & Water Company, on the White River in the Ozark Mountains, some 40 miles from Springfield, Mo., the Electric Bond Deposit Company was chartered on Feb. 24 under the laws of the State of Delaware. The company is capitalized at $15,000,000 and is authorized to deal in public-utility securities.

Kings County (N. Y.) Electric Light & Power Company Directors.—At the annual meeting of the Kings County Electric Light & Power Company and its affiliated company, the Edison Electric Illuminating Company of Brooklyn, the following were unanimously re-elected directors for the coming year: Frank Bailey, William Berri, A. N. Brady, N. F. Brady, H. C. Du Val, Walton Ferguson, W. W. Freeman, Bernard Gallagher, William V. Hester, Seth L. Keeney, Thomas E. Murray, W. F. Sheehan and J. N. Wallace.

Electric Bond & Share Company.—At the annual meeting of the Electric Bond & Share Company, 71 Broadway, N. Y., held in Schenectady, N. Y., last week, A. J. Hemphill and E. W. Hill, president and treasurer, respectively, of the Guarantee Trust Company of New York, were elected directors to succeed G. B. Moffat and A. M. Young, both deceased. The other retiring directors were re-elected.

Goulds Manufacturing Company Annual Meeting.—At the annual meeting of the board of directors of the Goulds Manufacturing Company, Seneca Falls, N. Y., on Feb. 26, all of the officers who have served during the past year were re-elected. In the annual report on the business of the year a slight increase over the preceding year was shown in both the gross amount of sales and net profits.

Foreign Trade Opportunity.—Under Schedule No. 8202, in the *Daily Consular and Trade Reports* of Feb. 21, an American consul in a Latin-American country states that an electric-light company in his district wants bids on a 200-hp engine and generator. Further particulars can be obtained from the Bureau of Manufactures, Washington, D. C.

Addresses at Byllesby Banquet.—The addresses delivered at the banquet given by H. M. Byllesby & Company to the staffs of that organization and affiliated companies on Jan. 5, 1912, in the Congress Hotel, Chicago, have been printed in pamphlet form. The book makes a volume of seventy-eight pages and is an interesting record of a noteworthy gathering.

North Carolina Power Competition.—Options on property on the Yadkin River, near Salisbury, N. C., are being taken by a French syndicate which plans to construct a $2,000,000 hydroelectric plant in this section. The new company, it is understood, will be a competitor of the Southern Power Company, which operates in the territory.

Fort Worth (Tex.) Plant Approaching Completion.—The new two-million-dollar plant of the Fort Worth Light & Power Company, of Fort Worth, Tex., now under construction, it is expected, will be ready for operation in July.

Financial.

Annual Report of Commonwealth Edison Company.—At the annual meeting of the stockholders on Feb. 26 President Samuel Insull, for the board of directors of the Commonwealth Edison Company of Chicago, presented a report covering fifteen months on account of a change in the company's fiscal year to make the fiscal year, for convenience, the same as the calendar year, which is the required basis for returns to the United States government under the corporation tax law. "During these fifteen months," reported Mr. Insull, "all the bonds of the Chicago Edison Company outstanding at the time of the last report have been retired and the mortgage of that company has been canceled and released of record, so that with the exception of a mortgage on certain real estate purchased subject to it, and on which there is a balance unpaid, but not due, of $130,000, this company now has no outstanding bonded or mortgage indebtedness other than that secured by the general mortgage of June 1, 1898, which, accordingly, now constitutes a first mortgage on practically all of the company's property. In addition to the bonds issued for the necessary refunding purposes, bonds secured by this general mortgage to the amount of $4,365,000 have been issued and sold during the above period covered by this report. In the same period an additional 15 per cent of the company's stock was offered for sale to stockholders, pro rata, at par, payable in quarterly instalments on the first days of November, 1911, and February, May and August, 1912. The aggregate amount of the subscriptions was $4,799,280, and so large a proportion of the stockholders availed themselves of the company's offer to accept advance payments that an unusually large cash balance has resulted, as shown on the balance sheet. Reference was made in the last annual report to the company's acquisition of a large tract of land on the North Branch of the Chicago River, north of Belmont Avenue, on which to erect a large power-generating plant. It has fortunately proved unnecessary to push building operations as rapidly and extensively as originally thought probable, but the first section of the power-plant building has been practically completed, and a portion of the machinery has been installed. The work at present contemplated is expected to be finished in ample time for the company's requirements." After making reference to the establishment by the company of a service-annuity system, as has been previously mentioned in these columns, Mr. Insull states the earnings and expenses for the fifteen months ended Dec. 31, 1911, as follows: Operating revenue, $17,336,835.77; operating expenses (including depreciation), $9,594,605.82; net operating revenue, $7,742,229.95; taxes and municipal compensation, $1,316,702.80; operating income, $6,425,527.15; other income, $192,025.54; total income, $6,617,552.69. From this was deducted interest on bonds, $1,919,943.61, and depreciation reserve (under the requirements of

the company's general mortgage), $680,000.00, leaving available for dividends $4,017,609.08; dividends paid amounted to $2,712,315.10, leaving a balance carried to surplus of $1,305,293.98. It is stated, unofficially, that the gross income on a yearly basis was $14,023,092, which is over 7 per cent in excess of the corresponding income for the year ended Sept. 30, 1910. The company now has five generating stations and thirty-seven substations. Its connected business (exclusive of electrical energy supplied to other public-service corporations) amounted to the equivalent of 7,212,504 standard 16-cp lamps on Dec. 31, 1911. Mr. Insull calls attention to a departure in this report from the previous practice of including income from the sales of merchandise in "gross earnings," and the cost of this merchandise business in "expenses." The present report gives only the net profit from the sales of merchandise, after deducting expenses, this item being included as a part of "other income." The condensed balance sheet shows total assets of $77,682,364, of which $69,566,781 is the value of plants, real estate, etc. The amount of cash on hand was $4,996,114 on Dec. 31, 1911, and the surplus on that date was $4,330,701. The value of coal in storage was $270,786. Liabilities include $35,909,035 stock issued or subscribed and paid for, $32,000,000 in bonds and a depreciation reserve of $3,433,839. The election of directors resulted in no change in the board.

Luzerne County (Pa.) Gas & Electric Bonds.—First-mortgage refunding and improvement 5 per cent gold bonds of the Luzerne County Gas & Electric Company, of Plymouth, Pa., are being offered (subject to change) at 99 and interest, yielding about 5 per cent. A circular describing the offering states that the Luzerne company is incorporated under the laws of the State of Pennsylvania, and is a consolidation of the Wyoming Valley Gas & Electric Company and the Hazleton Gas Light Company. It supplies, without competition, gas and electric light in the boroughs of Wyoming, Plymouth, Luzerne, Kingston, and a number of other neighboring localities in Pennsylvania, and the entire gas business in the city of Hazleton and adjacent territory. Its authorized capitalization consists of $3,500,000 first-mortgage refunding and improvement 5 per cent gold bonds and $2,000,000 common stock (all of which is owned and controlled by the American Gas Company). There are $1,796,000 of the bonds outstanding, $36,000 are reserved to retire a like amount of underlying liens, and $1,668,000 are reserved in the hands of trustees to be issued under careful restrictions for future requirements. All of the common stock is outstanding. Since organization of the Luzerne company in 1908, when it was acquired by the American Gas Company, the latter has expended a sum in excess of $725,000 on the property. There are now under way or about to be undertaken extensions and improvements for the calendar year 1912 costing approximately $50,000. The main power house of the Luzerne company is located on the river banks in the borough of Plymouth and has a capacity of 5500 kw. Gross earnings of the company in the year ended Dec. 31, 1911, were $271,833, and the surplus after payment of operating expenses, maintennace, taxes and bond interest was $51,184, as compared with $31,519 in the previous year.

Stromberg-Carlson Telephone Manufacturing Company's Report.—F. N. Kondolf, president of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has presented his annual report for the year ended Dec. 31, 1911, to the stockholders of the company. In addition to the manufacture of telephone apparatus the company manufactures aerial and underground cable. Its net income for the year, after deducing expenditures for ordinary repairs and maintenance, amounting to $27,866, was $81,323. From this was deducted $64,360 for depreciation and accrued renewals and $6,755 for interest on loans, leaving net profits for the year of $10,208. Sale of the Chicago property of the company in March, 1911, netted profit of $60,565. These returns, added to a balance of $260,439 on Dec. 31, 1910, made a total surplus of $331,212, from which accumulated preferred dividends of $183,750 were deducted. These were accumulated preferred dividends of 12¼ per cent covering the period from Oct. 1, 1906, to July 1, 1908. After this deduction the surplus as of Dec. 31, 1911, stood at $147,462. In his remarks to the stockholders, President Kondolf says that the company's finances and plant are in excellent condition, that many improvements have been made in its products, that its capital is adequate, that it has no debts, and that its sole need is a larger volume of business.

Pacific Light & Power Bonds Offered.—The unsold balance of $10,000,000 first and refunding mortgage 5 per cent sinking fund gold bonds of the Pacific Light & Power Corporation is being offered by New York bankers at 93 and interest, yielding about 5.45 per cent. This company, as previously noted in these columns, sells energy for lighting, power and street railway purposes in Los Angeles, Cal., and vicinity, and controls the Southern California Gas Company, which sells gas in the same territory. The present equipment of the company consists of steam generating plants of 55,000-hp capacity, hydroelectric plants of 20,000-hp capacity, and 450 miles of transmission lines. To provide for increasing business, the company will build two hydroelectric plants whose initial capacity will be 53,000 hp, and whose ultimate capacity will be 160,000 hp, 275 miles of transmission lines, and storage capacity of 38,000 acre-ft. Earnings of existing plants for the year ended Dec. 31, 1911, were over twice the interest charges on the present funded debt. When the new plants are placed in operation it is expected that with increased economy of operation and increased deliveries of energy the net earnings will be about two and one-quarter times the new interest charges, including interest on the present issue.

Mountain States Telephone Company's First Annual Report.—The report of the Mountain States Telephone Company—the successor of the Colorado Telephone, the Rocky Mountain Telephone and the Tri-State Telephone companies, as previously mentioned in these columns—for the year ended Dec. 30, 1911, shows the following results, for which no comparison is possible, since the new company has been in operation for only approximately six months, and this is its first annual report: Total revenue, $5,870,151, including exchange service, $4,327,375; toll service, $1,460,127; dividends and interest, $77,712, and miscellaneous, $4,935. Expenses were $2,804,026, as follows: Operation, $2,489,854; current maintenance, $928,473; depreciation, $801,168; taxes, $307,349, and interest, $277,180. Deduction of these amounts left a balance of $1,066,124.

Cities Service Company's Year.—In the twelve months ended Jan. 31, 1912, gross earnings of the Cities Service Company were $944,712. This company, as previously mentioned in these columns, was incorporated under the laws of the State of Delaware in September, 1910, as a holding company for the companies operated in Denver, Col., Spokane, Wash., and Joplin, Mo., by H. L. Doherty & Company, 60 Wall Street, New York. Expenses of the Cities Service Company in the period stated were $53,350, leaving net earnings of $941,361. Preferred dividends amounted to $527,655 and common dividends to $152,589. The surplus for the period was $261,116.

Massachusetts Lighting Companies Stock.—Stockholders of the Massachusetts Lighting Companies at their annual meeting last week authorized the trustees to issue and dispose of $785,200 (par value) additional capital stock, making the total authorized issue $5,000,000. Of the proceeds of the new stock, about $431,600 will be used to take up notes of underlying companies, $300,000 will be used for extensions to property and plant during the next year and a half, and the balance, $53,600, will be used for general purposes.

Consolidated Gas, Electric Light & Power Company to Issue Debenture Stock.—Application has been made to the Maryland State Legislature by the Consolidated Gas, Electric Light & Power Company, of Baltimore, for permission to issue debenture stock. The amount of the issue and the disposition planned for the proceeds are not known.

MARKET PRICES.

	Feb. 20.	Feb. 28.		Feb. 20.	Feb. 28.
Allis-Chalmers	⅞	⅞*	Mackay Companies..	82¼	82½
Allis-Chalmers, pf...	6½*	5	Mackay Cos., pf....	70*	70½*
Amalgamated Cop...	65⅛	67¼	Philadelphia Elec...	18¼	18
Boston Edison.....299		298	Western Union.....	85	85
C'monwealth Edison.142		144	Westinghouse	73¼	73⅝
Elec. Storage Bty...	54½	54½	Westinghouse, pf...	120*	120*
General Electric....159½		160½			

*Last price quoted.

Personal.

Mr. Thomas Foulkes has been elected president of the Board of Public Utility Commissioners of Los Angeles, Cal.

Mr. Charles J. Griffith has been elected general manager of the Little Rock Railway & Electric Company, Little Rock, Ark.

Mr. Theodore B. Comstock has resigned as secretary and chief engineer of the Board of Public Utility Commissioners of Los Angeles, Cal.

Mr. Sigmund Bergmann has received from Emperor William the title of "Geheimer Baurat" in recognition of the services he has rendered to the German electrical industry.

Dr. Elihu Thomson has been awarded the Elliott Cresson medal of the Franklin Institute in recognition of his leading and distinguished work in the industrial applications of electricity.

Mr. R. B. Cressman has become general sales manager of the Opalux Company, 258 Broadway, New York. Mr. Cressman was formerly with the Arrow Electric Company, Hartford, Conn.

Dr. Alexander Graham Bell has been awarded the Elliott Cresson medal of the Franklin Institute in recognition of his solution of the problem of the electrical transmission of articulate speech.

Mr. F. H. Aldrich, formerly superintendent of repairs for the International Harvester Company, Chicago, has joined the staff of the National X-Ray Reflector Company as sales engineer.

Prof. George F. Sever will deliver a lecture before the Electrical Engineering Society at Columbia University on the "Illumination of a Large City" on Thursday evening, March 7.

Mr. Arthur H. Ford, professor of electrical engineering in the University of Iowa, Iowa City, read a paper on "Street Lighting" before the Iowa Engineering Society in Davenport on Feb. 22.

Dr. Albert A. Michelson, of the University of Chicago, has been awarded the Elliott Cresson Medal of the Franklin Institute in recognition of his original investigations in the field of physical optics.

Dr. E. W. Morley has been awarded the Elliott Cresson medal of the Franklin Institute in recognition of his important contributions to chemical science and particularly of his accurate determinations of fundamental magnitudes.

Mr. Arthur J. Bruen has resigned as manager of the Paterson office of the Watson-Flagg Engineering Company, of New York, to become vice-president and manager of the construction department of the Electromechanical Company, Baltimore, Md.

Mr. Napoleon H. Boynton, who has been assistant manager of the publicity department of the National Electric Lamp Association, Cleveland, for the past three years, has been appointed manager of that department, succeeding Mr. P. S. Dodd.

Dr. S. W. Stratton, director of the United States Bureau of Standards, has been awarded the Elliott Cresson Medal of the Franklin Institute in recognition of his work in physical science and metrology and its application in the arts and industries.

Mr. Harold W. Clapp, who has supervised electrification work for the Southern Pacific Company in Alameda County, Cal., has been appointed assistant electrical engineer of the company, of which the chief electrical engineer is Mr. Allen H. Babcock.

Mr. Ralph Beman, of the National Electric Lamp Association, Cleveland, Ohio, read a paper entitled "Illumination for the Electrical Engineer," at the regular monthly meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers.

Mr. Bertram M. Downs has resigned as director and vice-president of the Brookfield Glass Company, New York, after an association with the company extending over a period of twenty-six years. Mr. Downs will take a well-deserved rest before engaging again in active business.

Mr. Horatio A. Foster has just become connected with J. G. White & Company, New York. Mr. Foster has been associated for the last two or three years with B. J. Arnold and has assisted Mr. Arnold in appraisal work of electric properties in Pittsburgh, Detroit, Los Angeles and other cities.

Mr. Samuel G. Dunham, who for eleven years has been vice-president of the Hartford (Conn.) Electric Light Company, has been elected president of that company to succeed his brother, Mr. A. C. Dunham, an account of whose retirement after thirty years of service was published in these pages on Feb. 17.

Mr. Walter G. Clark, electrical and commercial engineer, of 149 Broadway, New York, has recently been appointed consulting engineer to and American representative of the Victoria Falls & Transvaal Power Company, of London and South Africa. Mr. Clark is at present in London and will later go to Paris before returning to New York about April 1.

Mr. Austin C. Dunham, retiring president of the Hartford Electric Light Company, had a banquet tendered to him by the board of directors of the company on Feb. 14, at which he was presented with a silver loving cup. The cup is suitably engraved with a tribute to Mr. Dunham as a man and in recognition of his worth to the company and to the city in making electricity commercially available for lighting and power.

Mr. C. O. Baker, who has been for the past few years with the Wheeler Reflector Company, Boston, has resigned that connection, and on the eve of his departure a farewell dinner was tendered to him by the company at the Hotel Thorndyke on Feb. 26, followed by a theater party. During the evening Mr. Baker was presented with a handsome watch fob by his associates in the company as a token of the esteem in which he has been held.

Mr. W. J. Harvie, chief engineer of the Syracuse Rapid Transit Railway, Utica & Mohawk Valley Railway and Oneida Railway, has been appointed railway manager of the operating department of J. G. White & Company, New York. Mr. Harvie succeeds Mr. J. N. Shannahan, who resigned recently from the White organization to accept the position of vice-president and general manager of the Newport News & Old Point Railway & Electric Company, as noted in this column Feb. 3.

Mr. G. A. Trube, who has been associated with the British Westinghouse Company in England for the past ten years, has just resigned his position and gone to Paris, where he will assume the duties of manager of the Société Anonyme Westinghouse, whose head office is at 7 rue de Berlin, with works at Le Havre. Mr. Trube is best known in England from his association with the electric brake department of the Westinghouse interests, but at the time of his resignation he was acting as manager of the engine sales department.

Mr. W. J. Middleton, of the Simplex Electrical Company, Cambridge, Mass., read a paper entitled "The Manufacture of Insulated Wires and Cables" before the students of the course in industrial electricity at Franklin Union on Wednesday evening, Feb. 21. The various machines and processes by which a bare copper wire was converted into a multi-conductor insulated cable were described and illustrated by lantern slides. At the conclusion of the lecture Mr. Middleton exhibited samples of the various wires and cables previously described.

Mr. Matthew C. Brush, assistant to the vice-president of the Boston Elevated Railway Company, has been appointed second vice-president, dating from March 1. Mr. Brush is one of the best known public-utility officials in the East, and although a man in his early thirties, has attained practically a national reputation as an electric-railway executive. He was at one time vice-president and general manager of the Boston Suburban Electric Companies, which controlled among other properties the central-station system of the Waltham Gas Light Company, now a part of the Boston Edison system. A large share of his time in recent years has been devoted to the improvement of public relations and operating efficiency.

Mr. Frank D. Beardslee, manager of the commercial en-

gineering department of the Union Electric Light & Power Company, of St. Louis, has been promoted to be sales manager of the company, the change to take effect March 15. The commercial-engineering and sales-management departments have been consolidated, Mr. L. F. Philo, the present sales manager, having resigned. Mr. Beardslee has been connected with the company or its predecessors since 1889, starting in as a boy. He has made a reputation for himself for his originality and resourcefulness in expanding sales of electrical energy, also for his courtesy in dealing with customers and others and a constant readiness to co-operate with all other forms of electrical enterprise. He is a member of the Commercial Section of the National Electric Light Association, the Engineers' Club of St. Louis, the Sons of Jove and the St. Louis League of Electrical Interests, of which he served as secretary in 1911.

Mr. B. J. Denman has been appointed chief engineer of power plants for the Edison Illuminating Company of Detroit, where he is in charge of the 85,000-kw Del Ray stations, whose large boilers and other unusual engineering features have attracted much attention recently. His duties also include supervision of the company's downtown steam plants and step-up substation. Although youthful for the responsibilities which he bears, Mr. Denman entered the electrical field in 1892, serving as oiler, car-shop helper and conductor with the old Toledo railway company. From 1895 to 1899 he acted as electrician for the Toledo & Maumee Valley Traction Company and the next year joined the instructional staff of Toledo University. In 1900 and 1901 he engaged in consulting engineering work with Mr. W. G. Clark, and from 1902 to 1905 acted as electrical engineer for the Toledo, Bowling Green & Southern Traction Company, in charge of power houses, shops, rolling stock and overhead lines. In 1905 Mr. Denman joined the Detroit Edison organization, with which he has since been connected in a variety of capacities. In addition to commercial-engineering work, he was called upon to do practically all of the appraisal work for the Detroit companies, besides being detailed on special engineering and the supervision of power-house construction. In his position as chief engineer, Mr. Denman now has charge of all construction work going on at the plants, which was previously performed by a separate staff. Mr. Denman is a graduate of the University of Michigan, where he has since served as assistant professor of mechanical engineering and nonresident electrical engineering lecturer on power plants and substations and on railway engineering. Mr. Denman is a member of the Detroit Engineering Society and is an associate of the American Institute of Electrical Engineers.

Obituary.

Mr. Samuel Morris Dodd, whose death on Feb. 12 was announced in the *Electrical World* of last week, had much to do with the electrical upbuilding of St. Louis in the fields of both operating and manufacturing. For many years prior to Jan. 1, 1912, he was president of the Wagner Electric Manufacturing Company, and before that he was president of the Missouri Electric Light & Power Company, later reorganized as the Missouri Edison Company, which was absorbed by the present Union Electric Light & Power Company. He was a conspicuous figure in the business world of St. Louis, a man of wealth, a patron of the arts and a generous benefactor of numerous charitable organizations. His death, which occurred at the ripe age of seventy-nine years, was due to heart disease and was not unexpected. Mr. Dodd was born on June 3, 1832, in the old township of Orange, N. J. At the age of fifteen he determined to go to work for himself, and he learned the trade of hatter, working in Orange, N. J., and in New York City. In 1851 the young man moved to St. Louis, and went to work for Nourse, Crane & Company, who conducted a hat, cap and fur business. It is said that young Samuel started the first set of books in St. Louis conducted in modern fashion. He early displayed unusual business ability and soon came to be considered one of the best fur experts in the Mississippi Valley, judging at sight the value of furs brought in by the Indians. He made long journeys over the country, buying furs and pelts. For a number of years after first coming to St. Louis, the young merchant slept on the counters at the store when in town, opened the modest establishment in the morning and cooked his own breakfast. After a few years Mr. Dodd secured an interest in the business, and eventually the concern came to be known by successive changes and enlargements as the Dodd-Brown Company. This company was incorporated about 1865 and continued doing business up to about 1886. It was one of the leading business houses of St. Louis. At the age of fifty Mr. Dodd found himself in possession of a large fortune, and he cultivated more extensively his taste for art. In 1886 general crop failures involved the Dodd-Brown company and the brunt of the difficulty was borne by Mr. Dodd, who sacrificed his entire private fortune. At this time Mr. Dodd disposed of all his works of art. Some of his pictures brought what were considered at that time fabulous prices, and are now prized features of well-known collections in London and elsewhere. In the year 1886, at the age of fifty-four, Mr. Dodd, after taking a trip abroad to recuperate, returned to St. Louis to lay the foundations for a second fortune. When the Westinghouse Electric & Manufacturing Company started to build alternating-current apparatus under foreign patents, it was necessary to find some suitable place to try the alternating-current form of distribution out on a commercial scale. Mr. Dodd, who had been associated closely with Mr. George Westinghouse, consented to organize a company in St. Louis to build an alternating-current central-station plant on a large scale. This company, organized in 1888, was known as the Missouri Electric Light & Power Company at first, and later as the Missouri Edison Company. Mr. Dodd was its president from the first. This company built what was at that time the largest alternating-current central-station plant in the United States and perhaps in the world. The station was at Locust and Twentieth Streets and generated electrical energy at 1000 volts, 133 cycles, stepping down to 50 volts and 52 volts in the secondaries. A number of operating companies consolidated with this central-station property, which was reorganized in 1897 as the Missouri Edison Electric Light & Power Company. Mr. Dodd remained as president until 1903, when the present Union Electric Light & Power Company was formed. In the earlier days transformer breakdowns were frequent. In order to avoid the trouble of returning transformers to the Westinghouse works in Pittsburgh for repairs, a small repair shop was organized by the Missouri Edison Company, which was later taken over by Messrs. H. A. Wagner and Ferd Schwedtmann, who had been employees of the company. The work done was of such excellent nature that business began to come in from other customers, and in 1891 it was apparent that additional capital was desirable, so the Wagner Electric Manufacturing Company was incorporated in that year. From this small beginning has grown the extensive manufacturing enterprise of the Wagner company of to-day. The capital was largely subscribed by Mr. Dodd and his friends, and he was the president of the Wagner company from its incorporation until he retired on the first of the year, being succeeded by Mr. W. A. Layman, for many years the vice-president and general manager of the company. In the present sketch it is not practicable to enumerate all of Mr. Dodd's business activities. It may be mentioned, however, that he organized the American Central Insurance Company, of which he was treasurer and director for a number of years. He was also a director in the National Bank of Commerce, the largest financial institution in Missouri, for many years. He was a member of the St. Louis, Noonday, Country, Cuivre and Adirondack Clubs and honorary vice-president of the Missouri Society of the Sons of the American Revolution. He had a fine country place in the Adirondacks and he took great pleasure in spending his summer holidays there. He was fond of outdoor life and insisted upon having a houseful of young people around him. Mr. Dodd was one of the organizers and supporters of the Young Women's Christian Association in St. Louis; and in addition to other donations he gave it the use of his former residence on Garrison and Lucas Avenues rent free. The St. Louis League of Electrical Interests and a large number of other organizations adopted appropriate resolutions on the death of Mr. Dodd.

Construction.

THORSBY, ALA.—An arc street-lighting system is being installed in the business section of the town, which will probably be extended to all sections.

IMBODEN, ARK.—The local electric-light and water plants have been purchased by Brewer & Gore, Memphis, Tenn. Improvements will be made to the plant, including the installation of a new boiler and other machinery, rewiring the entire city, etc.

OSCEOLA, ARK.—Proposals will be received by C. L. Moore, Jr., Osceola, Ark., until March 15, for the construction of a power plant and installation of machinery, dynamo and other equipment, etc. Plans and specifications are on file at the office of C. L. Moore, Jr., Citizens' Bank of Osceola. Complete copies of same may be obtained from W. N. Gladson, engineer, Fayetteville, Ark., upon payment of $2.

ALAMEDA, CAL.—The Council has adopted a resolution to erect electroliers in district No. 5, which includes all the territory bounded by Lincoln Avenue, Chestnut Street, Clement Avenue and Park Street.

COHASSET, CAL.—The Cohasset Tel. Co. is planning to make extensive improvements to its plant and system between Cohasset and Chico.

GLENDALE, CAL.—Bonds to the amount of $40,000 have been voted for improvements to the municipal electric-light plant.

LOS ANGELES, CAL.—Plans are being prepared by the city engineer for the installation of electroliers on Seventh Street, between Hoover Street and the Los Angeles River, a distance of 3.8 miles. About 371 electroliers will be required.

NAPA, CAL.—The Great Western Pwr. Co., San Francisco, has applied to the City Council for a franchise to supply electricity for lamps and motors in Napa.

RED BLUFF, CAL.—The City Council is considering the question of calling an election to vote on the proposition of issuing bonds for the installation of a municipal electric-light plant. The Board of Trustees has instructed City Engineer Luning to make investigations and submit a report as to the cost of installing a municipal electric-light plant and water-works system.

REDDING, CAL.—The Northern California Pwr. Co. has decided to abolish all flat rates throughout the Sacramento and will install meters throughout the territory. The cost of installing meters is estimated at $75,000.

RICHMOND, CAL.—Arrangements are being made by the East Shore & Suburban Ry. Co. to install a 1500-kw generator to provide for the extension of the Richmond service and double-tracking its system. The cost of the power equipment is estimated at $40,000, which has already been purchased.

SACRAMENTO, CAL.—The Pacific Gas & El. Co. is planning to build a new hydroelectric power plant on the Sacramento River, near Sacramento, at a cost of about $744,000.

SAN LEANDRO, CAL.—The Board of Trustees has decided that all overhead wires must be placed underground within ninety days.

SAN RAFAEL, CAL.—The Western Pwr. Co. has applied to the Board of Supervisors of Marin County for a blanket franchise to erect transmission lines along the highways in the county.

SANTA MARIA, CAL.—The Southern Pacific Co. contemplates the purchase of the Santa Maria Valley spur line. It is proposed to extend the railway through the Santa Barbara forest reserve to Bakersfield, Cal.

SIERRA MADRE, CAL.—The Southern California Edison Co. has purchased a site on Bonita Avenue on which it proposes to erect a substation. The company is installing a new tungsten street-lighting system here.

TULARE, CAL.—The franchise applied for by the Tulare County Pwr. Co. was sold by the Board of Trustees to C. W. Rodgers for $850.

TULARE, CAL.—Bids will be received by E. Oakford, clerk of the Board of Trustees, for the sale of a 30-year franchise to erect transmission lines for the distribution of electricity in Tulare.

VAN NUYS, CAL.—Preparations are being made by the Edison El. Co. for the erection of an electric transmission line to supply electricity for lamps and motors in Van Nuys.

WATSONVILLE, CAL.—The Coast Counties Lt. & Pwr. Co. contemplates extending its transmission lines to Corralitos.

GOLDFIELD, COL.—The Golden Cycle Mill, Goldfield, is planning to discard its steam plant and utilize electricity to operate its plant. Energy will be secured from the Arkansas Valley Ry., Lt. & Pwr. Co., which will be supplied to the substation at 22,000 volts and stepped down to 2200 volts. The substation will be built of brick and equipped with induction motors, conduit wired. The equipment for mills will include mill hoists, rolls and lamps.

NEW HAVEN, CONN.—The United Illg. Co. is contemplating extending its service to Woodmont and to Woodbridge, as well as to Morris Cove and the lighthouse, to supply electricity for incandescent lamps.

NEW HAVEN, CONN.—The Connecticut Ry. & Ltg. Co. has accepted the charter amendments granted to the corporation by the last General Assembly, which give the company the right to make extensions to its electric railways in Milford and Orange and also in Waterbury. The extension authorized for the town of Milford and Orange is for an electric railway beginning at Cherry and North Streets in Milford and running northward to the Derby Turnpike, connecting near Wepawaug River with the tracks of the New Haven and Derby electric line. This line will be built by the Connecticut Co., lessee of the property of the Connecticut Ry. & Ltg. Co.

WILMINGTON, DEL.—Bids wil be received at the U. S. Engineer's office, Wilmington, Del., until March 18 for furnishing propelling machinery and electric installation for repair of U. S. inspection boat *Gannet*. For further information address Major R. R. Raymond.

WASHINGTON, D. C.—An American consul in a Latin-American country states that an electric-light company in his district has decided to double the output of its plant and is asking bids on one 200-hp engine and one dynamo. For further information address Bureau of Manufactures, No. 8202, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 5 for furnishing large and miscellaneous lots of electrical machinery, including two 10-kw wireless telegraph stations and equipment, brass bearings, fuel pump, electric igniter, etc. Captain R. J. Burt is disbursing officer.

WASHINGTON, D. C.—An American consul reports that a contract was recently awarded to a company in his district for city lighting. This company may erect a steam plant to generate electricity and bids will be asked for machinery which will involve an expenditure of from $100,000 to $200,000. For further information address No. 8209, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

FORT MYERS, FLA.—The Seminole Pwr. & Ice Co. contemplates the installation of an additional 600-hp direct-connected electric-generating unit and a complete condensing system during the next year. R. B. Reynolds is superintendent.

MOUNT DORA, FLA.—The Eustis Lt., Water & Pwr. Co., Eustis, has been granted a franchise by the Town Council to supply electricity here. It is proposed to connect with the Eustis-Tavares line at Tavares.

ST. PETERSBURG, FLA.—The Board of Trade is interested in a project to establish an ornamental lighting system in the business district. It is proposed to erect 42 ornamental lamp standards, each carrying five lamps, at a cost of about $2,100.

ATLANTA, GA.—The Georgia Pwr. Co. contemplates the construction of a network of interurban electric railways connecting Macon, Atlanta, Augusta, Columbus and other Georgia cities. Work will soon begin on surveys for the proposed electric railway and transmission line between Atlanta and Macon. William F. Parkhurst is representative of the company.

WHIGHAM, GA.—The proposition to issue $12,000 in bonds for construction of an electric-light plant, water-works system, etc., will soon be submitted to a vote.

TWIN FALLS, IDAHO.—The Great Falls & Twin Falls Wtr. Pwr. Co. contemplates increasing the output of its power plant at Shoshone Falls.

ALTON, ILL.—The McKinley Traction system has been granted a 49-year franchise to erect and maintain an electric-lighting system in Benbow City.

ARENZVILLE, ILL.—John G. Pratt, city engineer, of Virginia, Ill., is negotiating with the Village Board for the installation of an electric-light plant here.

BLOOMINGTON, ILL.—The installation of a lighting and heating plant at Miller Park is said to be under consideration by the city.

CHAMPAIGN, ILL.—J. R. Cravath, of Chicago, has been employed by the City Council as consulting engineer to prepare plans and specifications for a street-lighting system with ornamental poles to cover the entire city. Electricity is to be purchased from the electric light company at 2 cents per kw-hr.

CHANDLERVILLE, ILL.—The Ray E. Pickerel Lumber Co., Chandlerville, is reported to be in the market for a generator with sufficient output to supply 75 lamps.

COLCHESTER, ILL.—The Colchester El. Lt. Co. has secured a 15-year franchise in Blandinsville, and is trying to secure control of the Bushnell plant, so as to form a circuit to furnish electricity in Blandinsville, Sciota, Good Hope, Bushnell and on through Macomb. The central station will be located in Colchester. The equipment of the new plant will include two engines and two boilers.

FAIRVIEW, ILL.—The City Council has granted the Farmington Lt. & Pwr. Co. a franchise to extend its transmission lines to this city. Electricity to operate the system will be supplied from the Farmington plant.

JACKSONVILLE, ILL.—Mayor Davis will soon ask the City Council to provide for a bond issue of $55,000 for improvements to the municipal electric-light plant.

LA SALLE, ILL.—The question of installing ornamental tungsten cluster lamps in the business section of the city is under consideration.

OAKWOOD, ILL.—Plans are being considered to form a company here for the purpose of installing an electric-light system. Electricity for operating the system will be secured from the Illinois Traction system.

OTTAWA, ILL.—The Chicago, Ottawa & Peoria Ry. Co. has decided to erect an auxiliary steam-power plant in Ottawa. The plant will have an output of 1500 kw and will cost about $60,000. The erection of a

new service wire from the hydroelectric power plant at Marseilles to Ottawa will be undertaken, and arrangements are being made to equip all the sand plants west of Ottawa for electrical operation.

PAXTON, ILL.—The City Council has granted the Paxton El. Co. a new franchise for a period of 30 years, which practically assures the construction of a new plant in Paxton. Under the terms of the franchise the company is to supply electricity for lighting Pells Park, the city buildings and the proposed hospital for this city free of charge. Considerable reduction is also made in the price of street lamps.

RUSHVILLE, ILL.—The Rushville El. Lt. Co. is contemplating utilizing its exhaust steam for a central heating system.

VILLA GROVE, ILL.—The electric-light plant of the Villa Grove El. Co. was destroyed by fire on Feb. 11, causing a loss of about $20,000. It is understood that the plant will be rebuilt.

CULVER, IND.—Application has been made to the Council by Harry Saine for a franchise to erect a transmission line between Plymouth and Culver for the purpose of supplying electricity here.

FORT BRANCH, IND.—The City Council has granted J. H. Cole, South Bend, Ind., a franchise to construct and operate a combined water and light plant.

LAFAYETTE, IND.—The Indiana Gas Transportation Co., recently incorporated, proposes to construct and operate electric, artificial and natural gas, steam and hot-water-heating plants in Lafayette, Logansport, Peru, Wabash, Bluffton, Fort Wayne, Decatur, Lebanon, Thorntown, Frankfort and other towns and cities. The company is capitalized at $150,000. A. E. Scheithe, B. P. Shearon and L. E. Watson are incorporators.

LAUREL, IND.—The Town Council has granted a franchise to H. C. Jones to install and operate an electric-light plant here.

LEBANON, IND.—The capital stock of the Citizens' El. Lt. & Pwr. Co. has been increased by $100,000. The company proposes to install and operate an artificial ice plant, a gas plant and a central heating plant and other public utilities in addition to its electric plant in the city of Lebanon. T. C. McReynolds is president.

NEWPORT, IND.—The Town Council has granted a franchise for the installation of an electric-light system and has entered into a contract for street lighting for a period of 10 years, under the terms of which 35 tungsten street lamps of 200 cp will be furnished at the rate of $42 each per year. Electricity for operating the system will be transmitted from the Cayuga plant.

ROCKPORT, IND.—The directors of the Park County Tel. Co. have voted to expend $25,000 during the present year for extensions and improvements to its system.

BOONE, IA.—The Boone El. Lt. Co. is contemplating extending its transmission lines to several neighboring towns. The company has applied for a franchise in Ogden and is negotiating with the town officials of Ames, and with the Madrid El. Lt. & Pwr. Co., Madrid, to supply electricity in those towns.

BURLINGTON, IA.—The City Council is considering the installation of electroliers.

CORYDON, IA.—The City Council is reported to have decided to ask for bids for building an addition to the power house of the municipal electric-power plant.

FONTANELLE, IA.—A committee has been appointed to make investigations and secure estimates of the cost of the installation of an electric-light plant.

LAURENS, IA.—At an election to be held March 25 the proposition to construct an electric-light plant here will be submitted to a vote.

MAQUOKETA, IA.—The local electric-light plant has been purchased by A. E. Anderson, Chicago, Ill., president of the Anamosa-Oxford Junction Lt. & Pwr. Co.

NEW HAMPTON, IA.—The Council is considering the installation of electroliers on several streets in the spring.

OAKLAND, IA.—The citizens have voted in favor of the proposition to grant a franchise to Tubbs & Hammer to install a system to supply electricity for lamps and motors here.

ROCKWELL CITY, IA.—The property of the Rockwell City El. Lt. & Pwr. Co. has been purchased by J. W. Hurst, of Frederick, S. D., who will take possession at once.

UTE, IA.—A petition has been presented to the City Council asking for the installation of electroliers.

ATCHISON, KAN.—The City Council has adopted a resolution to submit a bond issue of $125,000, for a municipal electric-light plant, to a vote at the regular spring election in April.

SCOTT CITY, KAN.—Preparations are being made by J. W. Lough & Co., Scott City, for the installation of an electric power plant, to cost about $100,000. The proposed plant will supply electricity here and throughout Scott County to operate irrigation pumps.

TOPEKA, KAN.—The annual report of the municipal electric-light plant submitted by G. G. O'Neill, superintendent, recommends the installation of a new generating unit at the plant.

CAMPBELLSVILLE, KY.—Surveys have been completed by James Davis and R. L. Russell for the proposed power plant on Robinson Creek, near Campbellsville. Negotiations are now under way for right-of-way for a transmission line from the Robinson Creek plant to Campbellsville.

CENTRAL CITY, KY.—The Kentucky Midland Coal Co. has decided to equip its extensive coal mines located near Central City for electrical operation throughout. Electric haulage and mine-cutting equipment will be installed.

FALMOUTH, KY.—Sealed proposals will be received by N. C. Ridgeway, Mayor, until March 11 for the installation of a 35-kva or 50-kva generating unit, consisting of an engine and generator, switchboard, boilers, series street lamps, etc., in accordance with plant and specifications prepared by Anderson & Frankel, engineers, Lexington, Ky.

HENDERSON, KY.—The electric-light committee of the Council has recommended an appropriation of $25,000 for enlarging the power plant and for improvements to the street-lighting system. It is proposed to install a 900-hp Westinghouse turbine, a duplicate of the present generator, to serve as an auxiliary to the present equipment, and to install a complete system of magnetite street lamps.

LEXINGTON, KY.—It is reported that a syndicate of Eastern capitalists have practically completed arrangements for the construction of a large dam across Dix River, 25 miles south of Lexington, and the erection of a large power plant to supply electricity for lamps and motors in the central Kentucky towns and cities, including Lexington, Richmond, Danville, Nicholasville, Lancaster and Harrodsburg. The cost of the project is estimated at about $1,500,000. L. B. Herrington, of Richmond, is representative of the syndicate.

LOUISVILLE, KY.—The Louisville Ltg. Co. will soon begin work on the extension of its electric service to Buechel, Ky.

OWENSBORO, KY.—Arrangements have been completed by J. W. Richardson, president of the Business Men's Association, for establishing and maintaining an ornamental street-lighting system in the business district. Mr. Richardson is now soliciting prices of lamp standards and wiring for the project. The merchants will pay for the installation of the system.

TOMPKINSVILLE, KY.—Plans are being considered to install an electric-light plant here. It is proposed to form a stock company to operate same. There is sufficient water-power within the town to operate the proposed plant the year around.

AUGUSTA, MAINE.—The capital stock of the Cumberland County Pwr. & Lt. Co. is reported to have been increased from $1,000,000 to $5,000,000. A. B. Leach & Co., New York, N. Y., and Clark interests of Philadelphia, Pa., which recently acquired control of the electric-light, power and railway systems in Portland and vicinity, are interested in the Cumberland company.

BALTIMORE, MD.—The contract for laying cables from the pipe-line power house to connect the city hall and other municipal buildings has been awarded to the Lord El. Co., New York, N. Y., for $10,440.

MYERSVILLE, MD.—The city of Myersville will petition the State Legislature for authority to issue $8,000 in bonds for the construction of an electric-light plant and water-works system.

WILLIAMSPORT, MD.—The Council has adopted a resolution recommending the Burgess and Commissioners to secure authority from the Legislature to issue bonds, not to exceed $40,000, for the installation of an electric-light plant and water-works system.

BOSTON, MASS.—The stockholders of the Massachusetts Ltg. Cos. have authorized the trustees to issue $785,200 in capital stock, $431,600 of the proceeds to be used to take up notes of underlying companies, $300,000 for extensions to property and plant during the next 20 months, and the balance of $53,600 for general purposes of the trust.

HOLYOKE, MASS.—The Board of Aldermen has authorized the city treasurer to negotiate a loan for $140,000, the proceeds to be used for extending and enlarging the municipal gas and electric systems.

NORTH BROOKFIELD, MASS.—Frank E. Winchell is interested in a project to install an electric-light plant to supply electricity to light Brookfield, East Brookfield, North Brookfield and West Brookfield.

CEDAR SPRINGS, MICH.—At an election held recently the proposition to grant a franchise to the Grand Rapids-Muskegon Pwr. Co. to supply electricity for lamps and motors here was carried.

GLADWIN, MICH.—The City Council has granted Charles W. Kuehl, Saginaw, a 30-year franchise to supply electricity for lamps and motors here. Mr. Kuehl proposes to erect a plant on the Cedar River at Chappel, 3 miles above Gladwin.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. has been granted franchises at Kent City and Sparta. Franchises have also been granted at Casnovia, Grant and Bailey to be voted on at the regular spring elections. The company proposes to erect a substation at or near Kent City which will supply these towns with electricity.

TRAVERSE CITY, MICH.—The City Council has taken an option on the plant of the Queen City El. Lt. & Pwr. Co. at $150,000. The proposition to purchase the plant is to be submitted to the voters on April 1.

GILBERT, MINN.—The Northern Minnesota Pwr. Co., recently organized, is planning to install an electric plant to supply electricity in Aurora, Biwabik, McKinley and Gilbert. D. A. Reed, of Duluth, is manager and consulting engineer.

PIERZ, MINN.—The village of Pierz is reported to be contemplating the installation of an electric-light plant. The Blakeslee storage-battery system is being considered.

ST. PETER, MINN.—The Council is considering the question of installing a new street-lighting system.

GREENVILLE, MISS.—The Delta El. Lt. & Pwr. Co. is planning improvements to its plant, including the installation of a 500-kw turbo-generator, 100-kw direct-connected exciter, switchboard, three 75-kw transformers, etc. The cost of the work is estimated at about $25,000.

HATTIESBURG, MISS.—The Hattiesburg Trac. Co. contemplates extensive improvements to its power house and also building several extensions to its railway in Hattiesburg in the near future.

BRANSON, MO.—The Ozark Pwr. & Wtr. Co. has begun work on a large water-power development on the White River, near Branson, Mo. The project includes a dam 50 ft. high and 650 ft. long, with power house and 15,000-hp equipment. Transmission lines will be erected to Springfield and the Joplin district. The enterprise is financed by Henry L. Doherty & Co., bankers, New York, N. Y. Construction and engineering work are in charge of the Ambursen Hydraulic Const. Co., of Boston, Mass.

ORRICK, MO.—Preparations are being made for the installation of an electric-light plant in Orrick. Mr. Barnes, of Bonner Springs, Kan., is interested.

ST. JOSEPH, MO.—Estimates have been submitted to the City Council by Robert E. McDonnell and G. E. Hines, electrical engineers, of Kansas City, of the cost of enlarging the municipal electric-light plant to provide for supplying electricity for commercial purposes. The cost of the improvements is placed at $300,000.

TOWNSEND, MONT.—The Butte El. & Pwr. Co., Butte, has submitted a proposition to the town of Townsend to purchase the municipal electric-light plant for $4,000, provided the town enters into a contract with the company for lighting the streets and public buildings for a period of 15 years. M. Hebgen, Butte, is general manager of the company.

CREIGHTON, NEB.—The property of the Creighton Gas & El. Lt. & Pwr. Co. has been purchased by Emory Hunt.

KEARNEY, NEB.—At an election held Feb. 15 the proposition to issue $40,000 in bonds for a municipal electric-light plant to supply electricity for street lighting was carried. The plan calls for the installation of an electric plant at the municipal water-works plant and an electrolier system in the downtown section.

MARQUETTE, NEB.—An election will soon be held to vote on the proposition to issue $2,800 in bonds for the installation of an electric-light system.

OMAHA, NEB.—Kountze Brothers, of New York, N. Y., are reported to have secured the water rights of the old Fremont Richards power canal project and to be negotiating for two others, located on the Platte and Loup Rivers. The plan contemplates taking water from the Platte River at a point opposite North Bend. A hogback forms a natural canal embankment which would carry the water to a natural reservoir located opposite Fairmont, where it is proposed to erect a generating plant. The project, including a transmission line to Omaha, will involve an expenditure of about $2,000,000. It is also stated that Kountze Brothers are negotiating for the property of the Hydro-Electric Pwr. Co., which contemplates taking the water from the Platte River at a point about 2 miles north of the south line of Douglas County, which would be carried by a canal to a reservoir near South Bend, where a generating plant is to be erected. A feeder canal with a headgate at Waterloo is also contemplated in this plan. Negotiations are under way for water rights on the Loup River above Columbus.

STANTON, NEB.—The citizens have voted to enlarge the municipal electric-light plant. The work will include an addition to the power house, the installation of a new engine, boiler, steam pump, heater, etc.

RENO, NEV.—The Commissioners of Washoe County have granted W. G. Douglas, who proposes to irrigate a large tract of land between Reno and Carson City by pumping water from Washoe Lake, a franchise to erect an electric transmission line. Mr. Douglas is building a power plant in one of the canyons near the lake to supply electricity to operate the pumps.

RENO, NEV.—Plans are being considered for the erection of another large hydroelectric power plant on the Truckee River. It is proposed to purchase Steamboat ditch or make arrangements to utilize it above a point near Laughton and enlarge the canal from the headgates to the site of the proposed penstock, utilizing the additional water which was appropriated by the Steamboat Ditch Co., which has a right to 10,000 in. for power purposes. P. H. Patriache, of Reno, is interested.

TRUCKEE, NEV.—The Southern Pacific Co., it is reported, is preparing to install an electric-power plant on the Truckee River for the purpose of furnishing electricity for its yards, shops and buildings here.

MANCHESTER, N. H.—The question of installing a new fire-alarm system and placing the wires underground is under consideration by the Board of Aldermen and Mayor. The cost of the work is estimated at about $50,000.

CAMDEN, N. J.—The light committee of the City Council has instructed Chief Electrical Engineer John Kelly, Jr., and City Engineer L. Farnham to prepare plans and estimates of the cost for the proposed electric-light plant for the city. It is understood that the plans will provide for a plant of sufficient output to supply 1200 arc lamps and 2500 incandescent lamps.

NEWARK, N. J.—The contract for electrical equipment for the Central High School has been awarded to Harry R. Jackson, at $5,824.

POINT PLEASANT, N. J.—The controlling interest of the Point Pleasant El. Lt. & Pwr. Co. and the Point Pleasant Trac. Co. has been acquired by Thomas W. Haldeman, Washington, N. J., who will assume general management of the properties.

RIVERSIDE, N. J.—The Riverside Trac. Co. has purchased the property of the Cinnaminson El. Lt., Pwr. & Htg. Co., Riverside, and of the Bordentown El. Lt. & Motor Co., Bordentown.

CARLSBAD, N. M.—The Public Utilities Co. has awarded a contract to the Pearson Construction Co. for the reconstruction of its dam here, at a cost of about $20,000.

WHITE OAKS, N. M.—The White Oaks Cat Mining & Leasing Co. is installing a large electric power plant at its mining property near here.

COHOES, N. Y.—The Adirondack Pwr. Co. has submitted a proposition to the Chamber of Commerce relative to a franchise to supply electricity in this city. If granted a franchise the company will locate its plant on the east side.

NEWBURGH, N. Y.—A petition has been presented to the City Council urging the installation of an ornamental street-lighting system on Broadway, between Colden and Mill Streets, and the removal of overhead wires on Broadway between Colden and Dubois Streets, and placing all wires underground.

NIAGARA FALLS, N. Y.—The El. Development Co., it is reported, is preparing to make extensive additions to its power house and equipment, which will involve an expenditure of more than $1,000,000. Four more units are to be installed, increasing the output of the plant from 80,000 hp to 120,000 hp. It is expected that the transmission line to Toronto will be duplicated.

OLEAN, N. Y.—The Olean El. Lt. & Pwr. Co. has submitted a proposition to the Council offering to furnish arc lamps at $65 each per year, provided it be given a ten-year contract for street lighting, and also agrees to make improvements to its plant involving an expenditure of $250,000. The City Council is considering establishing a municipal electric-light plant.

VALATIE, N. Y.—The Village Trustees will submit the proposition to establish a municipal electric-light plant and water-works system to a vote. The Albany Southern R. R. Co., Hudson, now supplies electrical service here.

WEEDSPORT, N. Y.—The installation of a municipal electric-light plant here is under consideration. It is expected that the question will be submitted to a vote in the near future.

AYDEN, N. C.—L. L. Kittrell, Ayden, N. C., is reported to be in the market for a 50-hp gasoline engine guaranteed to drive an electric plant carrying from 1200 to 1500 lamps.

CHARLOTTE, N. C.—The Southern Pwr. Co. has awarded a contract for construction of a third auxiliary steam power plant, which will be located near Charlotte. The plant will cost about $250,000 and will have an output of 10,000 hp.

MONTREAT, N. C.—The Mountain Retreat Association would like to receive prices on a 100-hp engine and boiler and will probably be in the market for a 50-kw dynamo. Rev. R. C. Anderson is president.

SILER CITY, N. C.—The City Commissioners have granted J. Wade Siler and W. D. Siler a franchise to install an electric-light system here.

CASSELTON, N. D.—The power house of the municipal electric-light plant is being installed. A new 25-hp gas engine and generator are to be installed.

CROSBY, N. D.—The installation of an electric-light plant here is under consideration.

CINCINNATI, OHIO.—The Allyn Engineering Co. has plans and specifications ready to issue for the proposed power plant for the Alvey-Ferguson Co., located at Oakley, Cincinnati, Ohio.

CINCINNATI, OHIO.—A movement has been started to acquire the Madisonville lighting plant, which became the property of the city when Madisonville was annexed, to be utilized as a municipal plant. Negotiations are under way for the sale of the plant. The question of establishing a municipal garbage-disposal plant is under consideration.

CINCINNATI, OHIO.—Sealed proposals will be received at the office of the supervising officer, Treasury Department, Washington, D. C., until March 15 for two engines and generators for the United States custom house and post office, Cincinnati, Ohio, in accordance with specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

MADISONVILLE, OHIO.—The installation of a new street-lighting system here is under consideration. The village has a municipal plant, which became the property of the city upon annexation. The plant will be discontinued and the service furnished by the Union Gas & El. Co., Cincinnati.

PANDORA, OHIO.—The Council has granted a franchise for the installation of an electric-light plant here.

RIPLEY, OHIO.—The Ohio River & Columbus Railway, a subsidiary of the Cincinnati, Georgetown & Portland Railroad, is to be equipped for electrical operation from Georgetown to Ripley within the next two months. The third-rail system will be used.

ST. MARY'S, OHIO.—The Western Ry. Co. is planning to increase the output of its power plant here this spring at a cost of about $100,000. New generators will be installed. The company proposes to supply electricity for lamps and motors as well as for transportation purposes.

SAND SPRINGS, OKLA.—The Sand Springs Interurban Ry. Co. has

commenced work on the erection of a new power plant and substation in Sand Springs.

FOREST GROVE, ORE.—The Southern Pacific Co. has been granted a franchise to build a branch from its main line to Forest Grove, to be operated by electricity.

SEASIDE, ORE.—The Mutual Tel. Co. has been granted a franchise to erect a telephone line from Seaside to Elk Creek River. W. D. Torrey is interested.

AVONDALE, PA.—The Chester County El. Co. contemplates remodeling its plant and proposes to supply electricity within a radius of 10 miles. The plant, it is understood, will be driven by steam turbines.

CLEARFIELD, PA.—A. W. Lee, J. W. Rigely and A. J. Musser, of Clearfield, are interested in a project to build an electric plant on the South Fork of Beech Creek.

EASTON, PA.—The Eastern Pennsylvania Pwr. Co. is planning to erect a transmission line from its plant on the Paulins Kill, across Knowlton and Hope Townships, to Dover. The town committee of Hope is considering lighting the streets of the town by electricity.

FREDERICKTOWN, PA.—Application will soon be made to Governor Tener for a charter for a new corporation to be known as the Millfred El. Lt., Ht. & Pwr. Co. If granted a charter the company will install an electric plant in Fredericktown at once to supply electricity throughout the township. Baratoto and Albert Bartenzetti and Prosper Bigi are interested.

HAUTO, PA.—The Lehigh Valley R. R. Co. is planning to erect a large power plant in Hauto, to cost about $2,000,000.

HUNTINGDON, PA.—The Raystown Water Pwr. Co., Huntingdon, is planning to erect a transmission line 50 miles long. The company will receive bids until March 15 for 2000 chestnut poles.

LANSFORD, PA.—The Lehigh Coal & Navigation Co. is planning the construction of a large electric plant here, at a cost of $3,000,000, to supply electricity to all the towns in the Lehigh Valley. Work will begin on construction of plant about April 1.

PITTSBURGH, PA.—The Dormont Borough Council is considering the question of installing an electric-light system.

PITTSBURGH, PA.—The City Council has appropriated $10,000 for changing the present street-lighting system in a portion of the North Side district. It is proposed to erect 100 ornamental lamp standards on Federal Street. Arc lamps will be replaced with tungsten lamps.

PITTSBURGH, PA.—The West Penn Trac. Co. has purchased the property of the Allegheny Valley St. Ry. Co., which operates from Aspinwall to Natrona, a distance of 22 miles.. The property of the Allegheny Valley Lt. Co. was also acquired by the purchase. The West Penn interests have inaugurated an extensive campaign for extending the lighting and power business in the new territory, and the company's transmission lines are being extended to connect with the new holdings.

ROSS, PA.—The Rosscommon Lt., Ht. & Pwr. Co., which proposes to erect an electric plant in Ross Township, Monroe County, will soon apply to Governor Tener for a charter. The company proposes to extend its transmission lines to Wind Gap, Pen Argyl, Bangor and possibly to Nazareth. The water-power at Ross Common will be utilized. G. A. Schneebeli, C. D. Schaeffer and D. M. Leopold, Nazareth; Dr. J. C. Keller, Wind Gap; E. A. Speer, Bangor; C. H. Latta and L. H. Mountney, Stroudsburg, are interested. Ross has not a post office.

PAWTUCKET, R. I.—The directors of the Pawtucket El. Co. have ratified a contract with the Stone & Webster Engineering Corpn., Boston, Mass., for the construction of an extension to the boiler-room section of the Tidewater Street power plant and the installation of four 520-hp Babcock & Wilcox boilers, equipped with mechanical stokers.

PORTSMOUTH, R. I.—The Fall River & Newport St. Ry. Co. has applied to the Town Council for a franchise to erect transmission lines to supply electricity for lamps, heat and motors here.

FAIRVIEW, S. D.—Arrangements are being made by the Sioux Valley Pwr. Co. for developing water-power of the Big Sioux River at Fairview, work on which will soon begin.

ADAMS, TENN.—A company has been formed for the purpose of promoting the construction of an interurban railway from Allens, Ky., via Adams, to Ashland City, Tenn. T. C. Williet, civil engineer, has been instructed to make a preliminary survey. The officers are: J. J. Hendrickson, president; Rev. George Rayburn, secretary, and S. S. Farmer, treasurer.

CAMDEN, TENN.—A movement is on foot to establish an electric-light system here. Power for operating the plant will be supplied from the planing mills of J. C. Durdin & Son.

CHATTANOOGA, TENN.—The Chattanooga Ry. & Lt. Co. has submitted a proposition to the Retail Merchants' Association offering to furnish electricity to maintain the proposed "Great White Way" on Market Street, to extend from Sixth Street to the terminal station, until December, 1914, free of charge. The plans call for the erection of 111 lamp standards, each carrying five lamps. It is proposed to have the merchants and property owners along the route pay for the cost of the installation.

MEMPHIS, TENN.—Proposals will be received at the United States Engineer's office, Memphis, Tenn., until March 12 for furnishing about 637,000 lb. wire, silicon bronze wire. wire strand, wire cables, staples and clips and 140 coils of manila rope. For further information address Major Clarke S. Smith.

NASHVILLE, TENN.—The Nashville Ry. & Lt. Co. is planning to extend its railway to the new amusement park at Buena Vista Springs, a short distance from Nashville.

NEWPORT, TENN.—The Carmichael interests of Asheville, N. C., which have held options for the past four years upon all lands adjoining the French River near Newport, are reported to have renewed their options and are now making surveys with a view of establishing a large hydroelectric power plant on the site. About $30,000 has already been expended for available mill-dam land, and a 70-ft. barrier, of concrete and steel, is to be erected soon across the river, 2 miles above Newport. It is estimated that about 18,000 hp can be developed.

BASTROP, TEX.—The Bastrop Water & Lt. Co. has filed amendments to its charter changing its name to the Bastrop Wtr., Lt. & Ice Co. and proposes to supply water, electricity and ice in Bastrop.

BRYAN, TEX.—The Bryan Pwr. Co. is contemplating the installation of a 250-hp Diesel engine and other improvements to its plant.

FORT STOCKTON, TEX.—Plans are being prepared for an irrigation project near Fort Stockton. It is understood that the plans call for an expenditure of $300,000 to irrigate 28,000 acres. John Brooks, of Boston, Mass., is interested.

FREDERICKSBURG, TEX.—Improvements are contemplated to the local electric-light plant, including the installation of two generators.

GREENVILLE, TEX.—The Eastern Texas Trac. Co. is planning to build a new power house and general offices in Greenville. J. B. Murphy is general manager.

HARLINGER, TEX.—The City Council has entered into a contract with the Harlinger Land & Wtr. Co. to furnish the city with water as soon as the plant is completed. The company expects to supply both water and light by June 1.

JACKSONVILLE, TEX.—The Jacksonville Ice & El. Co. is installing additional machinery and making other improvements to its electric plant. The company recently closed a contract with the city for installing 100 additional lamps.

KINGSVILLE, TEX.—The Kingsville Pwr. Co. is contemplating the erection of electric transmission lines through the irrigated territory around Kingsville to supply electricity to operate the pumping plants. A. L. Kleberg is manager.

LLANO, TEX.—Preparations are being made by N. J. Badu, of Llano, and associates, who are interested in the iron ore deposits in this section, for the installation of a large hydroelectric plant to supply electricity to operate their smelting plant. It is proposed to erect a large dam across the Colorado River, about 12 miles from here, to form a storage reservoir to supply water for the electric plant. The iron furnaces will be located near the hydroelectric plant.

MILES, TEX.—The local electric-light plant, which was recently destroyed by fire, will be rebuilt and enlarged.

PECOS, TEX.—W. C. Wilson, of Hoban, Tex., is promoting the installation of a large electric-power plant in Pecos and the erection of a transmission system to supply electricity to operate irrigation pumps throughout this section.

SAN ANGELO, TEX.—The San Angelo St. Ry. Co. has been reorganized under the name of the San Angelo Pwr. & St. Ry. Co. The new owners propose to erect a new power house and will purchase considerable new equipment and extend the system.

TOYAH, TEX.—The City Council has entered into a contract with the Toyah Lt. & Ice Co. for street-lighting. The company contemplates making improvements to its plant.

TYLER, TEX.—Preparations are being made to begin work on construction of an electric street-railway system here in the near future. The system will include about 7 miles of track. Thomas O'Hara, of Dayton, Ohio, owns the franchise.

SALT LAKE CITY, UTAH.—The Merchants' Lt. & Pwr. Co., Ogden, proposes to apply to the City Council for a 50-year franchise to supply electricity for lamps and motors in this city.

CENTRALIA, WASH.—Surveys have been completed by the Oregon-Washington R.R. & Nav. Co. for an electric railway from Centralia to Olympia, Wash.

PASCO, WASH.—The Pacific Pwr. & Lt. Co. is planning to erect a substation here, to cost about $20,000.

RAYMOND, WASH.—The property of the South Bend-Raymond El. Co. has been purchased by Sanderson & Porter, of New York, N. Y. The new owners contemplate extensive improvements to the system.

SPOKANE, WASH.—Contracts will soon be awarded by the Spokane & Inland Empire R. R. Co. for the construction of a small substation in Vera. The company expects to purchase soon three 350-kw transformers and auxiliary equipment.

TACOMA, WASH.—The School Board has approved plans for the installation of a lighting system at the Stadium, the cost of which is estimated at $3,000. Bids will be called for soon.

WHEELING, W. VA.—The Wheeling Trac. Co. contemplates the erection of a new substation here in the near future.

FOND DU LAC, WIS.—The Eastern Wisconsin Ry. & Lt. Co. contemplates the purchase of a new steam turbine and rotary converter.

MENASHA, WIS.—Plans are being considered for the installation of an ornamental street-lighting system from the intersection of Neenah to the north limits of the city, a distance of about 2 miles. The project is to be financed by the business men of the city.

MINERAL POINT, WIS.—The Public Service Co., of Mineral Point, is planning to extend its transmission lines from Mineral Point to Mifflin, Rewey, Cobb and Highland. The Inter-State Lt. & Pwr. Co. is erecting a new 33,000-volt line from Platteville north through Lima Township and east to the Mifflin district in order to supply electricity to the mines in the Livingston, Rewey and Mifflin camps at a cost of about $50,000. Another line is being built from Hazel Green to Shullsburg and Darlington and a loop in the high-tension line is planned which will take in Mineral Point and connect the district in Mifflin Township. The new extension into Shullsburg and Darlington will be separate from Galena. About $100,000 will be required to complete this extension to Darlington.

WINNIPEG, MAN., CAN.—Announcement has been made of extensive additions to the telephone system in Alberta, which will involve an expenditure of $2,000,000 and will include the erection of over 3000 miles of rural lines, 500 miles of long-distance lines over new routes and about 700 miles of additional circuits on existing long-distance routes; also a number of new exchanges as well as extensive additions to existing exchanges.

ST. STEPHEN, N. B., CAN.—The municipality of St. Stephen has taken an option on the entire output of the Eel River Ht., Lt. & Pwr. Co. The proposed plant will have an output of 3000 hp. R. G. Lee is secretary of the company.

ACTON, ONT., CAN.—The ratepayers have approved the by-law authorizing the Council to enter into a contract with the Hydro-Electric Power Commission for Niagara power and another by-law to issue $8,500 in debentures to equip the municipal electric system for hydro-power.

LINDSAY, ONT., CAN.—The Seymour Pwr. Co., it is reported, will erect a substation in connection with its transmission line from Peterborough to Lindsay. Electricity will be transmitted from Peterborough at 12,000 volts and stepped down to 4000 volts. J. S. Denick, of Trenton, has charge of the work at this point.

OTTAWA, ONT., CAN.—The Gloucester Township Council has entered into a contract with the Ottawa El. Lt. Co. for street lighting for a period of ten years.

SUDBURY, ONT., CAN.—The town of Sudbury has authorized debentures to the amount of $146,000, of which the proceeds of $16,000 will be used for fire hall and installation of fire-alarm system and $15,000 for construction of power house. George Elliot is town treasurer.

WELLAND, ONT., CAN.—The fire, water and light committee of the City Council has engaged an engineer to make investigations and place a valuation on the system of the Welland El. Co. The Council is contemplating purchasing the plant to be owned and operated by the municipality.

REGINA, SASK., CAN.—Plans for extension to the municipal electric-light plant have been submitted to the City Council, calling for an expenditure of $300,000 during the year. The plans call for the installation of an additional generator and the erection of a new power house equipped with electrical driven pumps to operate the new high-pressure system.

SASKATOON, SASK., CAN.—Tenders will be received by the City Commissioners until March 8 for the following apparatus: Five 500-hp water-tube boilers, five sets of automatic stokers, induced-draft plant and duplicate fans for economizers for 2000-hp capacity, two feed pumps, with necessary equipment, one 2000-kw high-pressure turbine with condenser, air pumps and necessary equipment, two 75-kw turbine exciters one generator panel, two exciter panels, with all necessary cables and apparatus from turbine to switchboard.

MERIDA, YUCATAN, MEX.—Preparations are being made to convert the local street-railway system, which is now operated by mules, into an electric transit line.

New Industrial Companies.

THE CHEMICAL ELECTRIC COMPANY, of St. Paul, Minn., has been incorporated with a capital stock of $50,000 to manufacture an electric lamp patented by Arthur W. Swanberg. The incorporators are: S. E. Redlund, Thomas C. Daggett and Mr. Swanberg.

THE ELECTRIC LIGHT & STARTER COMPANY, of Indianapolis, Ind., has been incorporated for the purpose of manufacturing electric-lighting and starting apparatus for automobiles and other vehicles. The incorporators are: Frank H. Wheeler, Joseph E. Bell, Charles C. Wedding and Harry J. Spann.

THE ENGLEWOOD CHANDELIER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $35,000 by E. A. Davis, A. F. Hanson and W. E. Pemberton. The company proposes to manufacture metal goods.

THE F. M. EULER ELECTRIC COMPANY, of Elizabeth, N. J., has been incorporated with a capital stock of $90,000 by F. M. Euler, J. Euler and R. W. Sailer, of Elizabeth, N. J. The company proposes to manufacture lamp sockets, electric devices, etc.

New Incorporations.

CORDOVA, ALA.—The Cordova Lt. & Pwr. Co. has been incorporated with a capital stock of $6,000 by E. T. Hendon, G. S. Elliott and J. M. Miller.

LITTLE ROCK, ARK.—The Dixie Pwr. Co. has been incorporated with a capital stock of $10,000 by George B. Rose, W. E. Hemingway and J. F. Loughborough. Mr. Rose is president of the company.

LITTLE ROCK, ARK.—The Arkansas Hydro-El. Pwr. Co. has been incorporated with a capital stock of $10,000 by W. L. Thompson, H. F. Fix, E. T. Stanfield, J. D. Arnold, Louis Rosenfield, W. D. Dickinson, Guy A. Watkins and B. A. Altheimer. The company proposes to erect a hydroelectric power plant on Little Red River near Higden, 55 miles north of Little Rock.

JACKSONVILLE, ILL.—The Jacksonville Gas & El. Co. has been incorporated by E. W. Fowler, Fred G. Buffe and H. E. Chubbuck to operate a public utility plant in Jacksonville.

EDINBURG, IND.—The Interstate El. Co. has been incorporated with a capital stock of $50,000 by William McConnell, G. H. Hornecker and C. J. Huff.

FORT BRANCH, IND.—The Fort Branch Wtr., Lt., Pwr. & Ht. Co. has been granted a charter with a capital stock of $25,000. The company has been granted a franchise to install an electric-light plant and a deep-well water system in Fort Branch. The officers are: W. L. Walters, president; S. R. Lockwood, secretary, and J. E. Troop, treasurer.

OWENSVILLE, IND.—The Owensville Wtr., Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 for the purpose of furnishing water, light, heat and power in Owensville. The incorporators are: C. B. Smith, G. B. Beresford, George R. Welborn and J. F. Cole.

Trade Publications.

ELECTRIC LUMINOUS RADIATORS.—The engineering department of the National Electric Lamp Association has recently issued Bulletin No. 19, illustrating and describing the electric luminous radiator and calling attention to the many ways in which it may be made a convenience in the home. The non-luminous type of radiator is mentioned and comparisons are drawn between the two kinds. A table of data of luminous radiator lamps in regard to size, wattage, voltage, etc., is inserted.

FLAMING-ARC HEADLIGHT.—"Westinghouse Metallic Flame Arc Headlight" is the title of a folder, No. 4202, illustrating and describing this new type of railway illuminant recently placed on the market by the Westinghouse Electric & Manufacturing Company. The front cover shows a beam of light from one of these lamps illuminating the track for a very considerable distance in front of the car. The descriptive matter illustrates the advantages of the metallic-flame lamp for this class of work.

STEAM TABLES FOR CONDENSER WORK.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued a handbook of steam tables with pressures below atmosphere expressed in inches of mercury referred to a 30-in. barometer, and including a discussion of the use of the mercury column, the errors in such measurements and constants for their correction. The handbook is published primarily for the assistance of engineers using and purchasing Wheeler condensers and condensing apparatus, copies not being for sale or general distribution.

HOUSE ELECTRICAL GOODS.—Edwards & Company, 140th and Exterior Streets, New York, have issued a 55-page catalog, illustrating and describing their large line of house electrical goods. As one of the pioneers in this branch—the firm having been founded in 1872—Edwards' goods have always occupied a front rank, and the catalog gives evidence that it continues a leader in its field. Every possible variety of house goods is listed, in most cases with an accompanying illustration. The final pages contain wiring diagrams and tables that will be found useful by the electrician.

Business Notes.

THE ECONOMY ELECTRIC COMPANY, Warren, Ohio, moved its offices on March 1 from the west side of the town into the Packard Block, which is conveniently located on the south side of the Public Square.

THE ELECTRICAL MANUFACTURING COMPANY, Denver, Col., is placing on the market an iron support or bracket for iron cabinets, outlet boxes, etc., which secures the advantages of proper alignment and projection for a determined thickness of plaster finish.

ALFRED F. MOORE SALES AGENCIES.—Sales agencies have been established by Alfred F. Moore, Philadelphia, in Chattanooga, Louisville and Birmingham, as follows: Chattanooga, magnet wire and weatherproof wire; Louisville, magnet wire and weatherproof wire; Birmingham, weatherproof, office, annunciator and rubber-covered wires and lamp cord. A large stock will be carried at each agency.

SCIENTIFIC ILLUMINATION.—The Electric Construction Company, 183 East Fourth Street, St. Paul, Minn., has established a depart-

ment of illuminating engineering under the direction of Mr. Arthur L. Abbott as illuminating engineer, with Mr. Clovis M. Converse as assistant engineer. The new department is completely equipped for the successful handling of all illumination problems.

THE STANDARD ELECTRIC TIME COMPANY, formerly of Waterbury, Conn., and at present located temporarily at Foxboro, Mass., will move to its new factory building on Logan Street, Springfield, Mass., during the month of April. The general office will also be moved to Springfield from Boston. Mr. George L. Riggs is president and general manager and Mr. G. F. Harter works manager of the company.

LOCKE INSULATORS.—The Locke Insulator Company, Victor, N. Y., has during the last two or three months closed contracts for suspension type transmission insulators as follows: New England Power Company, Massachusetts, 66,000 volts; Mexican Northern Power Company, Mexico, 110,000 volts; Southern California Edison Company, 66,000 volts; Puebla Tramway, Light & Power Company, Mexico, 110,000 volts; Cia Beneficiadora de Pozos, Mexico, 60,000 volts; Tri-City Railway & Light Company, Iowa, 33,000 volts.

LE CARBONE DYNAMO BRUSHES.—Mr. W. P. Poynton has accepted the position of sales engineer with W. J. Jeandron, United States agent for "Le Carbone" dynamo brushes. Mr. Poynton was for a number of years in the motive-power department of the Interborough Rapid Transit Company, New York, where he made a special study of brush operation. Previous to taking the present position he was rotary-converter expert for the New York erecting department of the Westinghouse Elctric & Manufacturing Company.

PULMOTORS.—Vice-president Arthur S. Huey, of H. M. Byllesby & Company, Chicago, has ordered ten "pulmotors" for installation at ten of the important Byllesby properties, delivery to be made as soon as possible. The pulmotor, which is manufactured by the Draeger Oxygen Apparatus Company, of Pittsburgh, Pa., aids in the resuscitation of persons overcome by asphyxiation, electric shock or poisoning—in all cases where respiration has been suspended or restricted. The properties selected for the initial installation are those at Pueblo, Col., St. Paul, Minn., Fort Smith, Ark., Mobile, Ala., Muskogee, Okla., Oklahoma City, Okla., Eugene, Ore., San Diego, Cal., Stockton, Cal., and Tacoma, Wash. The Commonwealth Edison Company, of Chicago, has tried out two of these machines during the past three months, and has demonstrated beyond question their great value in saving lives, sometimes in cases where physicians have given the patient up for lost. If the experience with these machines is satisfactory, "pulmotors" will be installed at every Byllesby property in a short time.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary-Treasurer, Geo. S. Emery, 11 N. Royal St., Mobile, Ala.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Convention, Chicago, Ill., Oct. 7-11, 1912.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Convention, Boston, Mass., April 18-20, 1912.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Convention, Richmond, Va., Sept. 3-5, 1912.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meeting, second Friday of each month, excepting June, July, August and September. Annual meeting, Boston, Mass., June 25-28.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, E. H. Hardin, Hot Springs, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Seattle, Wash.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Colo.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Colo.

ELECTRIC CLUB, CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL VEHICLE ASSOCIATION OF AMERICA. Assistant Secretary, Harvey Robinson, 245 West 42d St., New York. Meeting, fourth Tuesday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC & RAILWAY ASSOCIATION OF OKLAHOMA. Secretary H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Secretary, A. W. Zahm, Mason City, Ia Convention, Des Moines, Ia., April 24-25, 1912.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

LOUISIANA ELECTRICAL ASSOCIATION. Secretary, W. H. Bower Spangenberg, 627 Poydras St., New Orleans, La. Meets third Monday of each month.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. T. Street, 76 West Third St., St. Paul, Minn. Next annual meeting, March 20-22, 1912, Minneapolis, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo. Convention, Joplin, Mo., April 11-13, 1912.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual convention at Detroit, Mich., June 25-27, 1912.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next annual convention, July 17-19, 1912, Denver, Col.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., June 9-15, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St., West, Toronto, Can. Convention, Ottawa, Ont., June 19-21, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, P. S. Dodd, 1823 E. 45th St., Cleveland, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, W. A. Wadsworth, Schenectady Illuminating Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, T. W. Peters, Columbus Railway Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Convention June 21-25, S.S. Majestic.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss. Convention, Vicksburg, Miss., May 21-23, 1912.

National Electric Light Association, Nebraska Section. Secretary-Treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Next annual convention, Springfield, Mass., March 21 and 22, 1912.

National Electric Light Association, New Hampshire Section.

National Electric Light Association, Northwest Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

National Electric Light Association, Power Transmission Section. Secretary, D. B. Rushmore, 234 Union St., Schenectady, N. Y.

National Electric Light Association, Pennsylvania Section. Secretary-Treasurer, W. E. Long, Philadelphia, Pa.

National Electrical Inspectors' Association. Secretary, W. L. Smith, Concord, Mass.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago.

National Electrical Supply Jobbers' Association. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

National Fire Protection Association. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

National Independent Telephone Association. Secretary, Joseph B. Ware, Grand Rapids, Mich. Next annual convention, Feb. 7-9, 1912, Chicago, Ill.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Breakers Hotel, Cedar Point, Ohio, July 16-19, 1912.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

Pittsburgh Electric Booster Club. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

Rejuvenated Sons of Jove. Jupiter, R. L. Jaynes, Pittsburgh, Pa.; Mercury (Secretary), E. C. Bennett, St. Louis, Mo.

Society for the Promotion of Engineering Education. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

Society of Wireless Telegraph Engineers. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

Southwestern Electrical & Gas Association. Secretary, D. G. Fisher, 3419 Hall St., Dallas, Tex. Convention, San Antonio, Tex., April 25-27, 1912.

Street Railway Association of the State of New York. Secretary, J. C. Collins, Rochester, N. Y.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention St. Louis, Mo., Jan. 27-30, 1913.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

Wisconsin Institute. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Wisconsin Electrical Contractors' Association. Secretary, Albert Petermann, Milwaukee, Wis. Summer meeting, Waupaca and Chain-of-Lakes, Wis., August, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 20, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,017,648. VACUUM LIGHTNING ARRESTER; F. S. Chapman and J. T. Greene, Toledo, Ohio. App. filed Nov. 20, 1909. Vacuum chamber with baffles.

1,017,649. LIGHTNING ARRESTER; F. S. Chapman, Toledo, Ohio. App. filed Feb. 2, 1910. Vacuum chamber.

1,017,670. VOLTAGE REGULATOR; R. P. Jackson, Wilkinsburg, Pa. App. filed March 9, 1908. Current rectifier, field-magnet windings and resistor; without movable contacts.

1,017,671. TAPERING METAL BODIES; C. F. Jenkins, Washington, D. C. App. filed July 27, 1911. Abrasive and electrolytic action for sharpening razors, etc.

1,017,680. SANITARY MOUTHPIECE FOR TELEPHONES; N. M. Marcuse, Far Rockaway, N. Y. App. filed Jan. 25, 1911. Movable disinfecting pad.

1,017,689. ELECTRIC-WHISTLE ALARM; C. H. Rettmann, Chicago, Ill. App. filed May 6, 1911. Electromagnetically operated diaphragm for "noise horns," etc.

1,017,711. DEVICE FOR HOLDING TROLLEY POLES ON WIRES; W. F. Van Cleave and A. T. Woodall, Dallas, Tex. App. filed Oct. 18, 1909. Auxiliary guide plates in front of the wheel.

1,017,737. SERIES TRANSFORMER; G. A. Burnham, Cliftondale, Mass. App. filed Feb. 8, 1911. A closed circuited coil preserves the ratio of transformation under change of load.

1,017,740. ELECTRIC STOCK-QUOTATION BOARD; M. D. Compton, New York, N. Y. App. filed March 19, 1910. Cards and lights.

1,017,741. SUSPENSION DEVICE FOR TROLLEY WIRES AND THE LIKE; F. S. Denneen, Mansfield, Ohio. App. filed Dec. 20, 1906. Adjustable and flexible.

1,017,759. ELECTRIC CONDUIT; O. T. Hungerford, Belleville, N. J. App. filed Sept. 10, 1906. Subterranean.

1,017,874. ELECTRIC HEATER; L. E. A. Kelso, Provo, Utah. App. filed April 12, 1911. Water heater; immersion type.

1,017,916. POWER HAMMER; G. H. Rowe, Berwyn, Ill. App. filed Oct. 31, 1910. Solenoid lift; air cushion.

1,017,945. COMMUTATOR CONSTRUCTION FOR DYNAMO-ELECTRIC MACHINES; T. E. Allen, Milwaukee, Wis. App. filed Feb. 28, 1910. Air-cooled segments; for turbo-generators.

1,017,948. SWITCH FOR IGNITION SYSTEMS; G. H. Boynton, Dalton, Mass. App. filed July 13, 1908. Lever switch with safety plug.

1,017,967. TELEPHONE SELECTING DEVICE; F. E. Granger, Aberdeen, S. D. App. filed Sept. 29, 1909. Signaling and receiving apparatus for party line.

1,017,981. ELECTROPLATING WITH ZINC; A. A. Lemètre, Paris, France. App. filed May 29, 1911. Bath of $ZnSO_4$, NH_4Cl, Na_2SO_3, H_2SO_4 and H_2O.

1,018,003. CARBON ELECTRODE FOR ELECTRICAL PURPOSES; B. Redlich, Ratibor, Germany. App. filed Oct. 13, 1911. Connector of carbon with a metal core.

1,018,019. CONTROLLER; E. W. Stull, Milwaukee, Wis. App. filed July 20, 1910. Insulating drum molded on the shaft.

1,018,026. SAFETY SIGNAL APPARATUS; J. H. Alandar and R. McGregor, Chicago, Ill. App. filed Aug. 29, 1910. Signal to prevent crossing in rear of a car when another car is approaching from the opposite direction.

1,018,038. SIGNALING APPARATUS FOR TURPENTINE STILLS; R. Dunwody, Kirkwood, Ga. App. filed March 10, 1911. Alarm and register.

1,018,082. TELEPHONE TRANSMITTER; C. R. Rogers, Waverly, N. Y. App. filed April 10, 1911. Sterilizing material and diaphragm.

1,018,115. TELEGRAPHING SYSTEM AND APPARATUS; C. Kinsley, Chicago, Ill. App. filed Feb. 2, 1903. Chemical printing receiver.

1,018,141. COMMUTATOR; W. G. Viall, Bridgeport, Conn. App. filed April 28, 1910. For toy motors for toy electric cars, etc.

1,018,162. ELECTRIC BELL; S. Brown, Alexandria, Va. App. filed April 29, 1911. Two alarm circuits.

1,018,182. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed June 12, 1911. Resistance cup.

1,018,196. AUTOMATIC SWITCH; C. L. Kennedy, South Braintree, Mass. App. filed Dec. 13, 1909. For induction motor of split-phase type. Improvement on Patent No. 860,124.

1,018,198. TROLLEY; H. F. Kunieski and M. Swiecicki, Philadelphia, Pa. App. filed Sept. 16, 1911. Wheel with guard.

1,018,226. TELEPHONE REPEATING SYSTEM AND APPARATUS; C. Adams-Randall, New York, N. Y. App. filed April 2, 1910. Automatic; electromagnetic controlling switches.

1,018,239. AUTOMATIC FUSE RESETTER; J. B. Elkin, Columbia, S. C. App. filed Aug. 10, 1911. Reel for resetting fuse wires in telephone and telegraph circuits.

1,018,297. SWITCH AND CUT-OUT BOX; W. P. Carstarphen, Jr., Denver, Col. App. filed May 7, 1909. Flush wall box for fuses, etc.

1,018,304. FOG-SIGNAL LIGHT; R. C. Douglas, Oakland, Cal. App. filed Oct. 13, 1910. Arc light with a signal-controlled electrode.

1,017,309. ELECTROMAGNETIC ENGINE; H. J. Ford, San Quentin, Cal. App. filed May 6, 1911. Multiple solenoid reciprocating.

1,018,322. VOLTAGE-REGULATING SYSTEM; R. P. Jackson, Wilkinsburg, Pa. App. filed Jan. 10, 1908. To maintain the voltage regardless of variations in the amount and power factor of the load.

1,018,328. MINE-ALARM INSTRUMENT; H. W. Lee and G. H. Weedman, Mount Morgan, Queensland, Australia. App. filed Feb. 11, 1911. To indicate settling or ground falls.

1,018,332. ELECTROPLATING PROCESS; F. J. McElhone, Jersey City, N. J. App. filed March 26, 1908. For electrotyping; the graphite is treated with an organic acid, then applied, washed and plated.

1,018,334. SPRING CONTACT PLATES; T. E. Murray, New York, N. Y. App. filed June 29, 1911. Mounted to receive a plug.

1,018,355. BATTERY FOR CLEANING TARNISHED METALS; R. H. Galbreath, Denver, Col. App. filed May 29, 1911. The plates are held together by a frame.

1,018,356. AUDIPHONE RHEOSTAT AND SWITCH; K. B. Hastings, Boston, Mass. App. filed April 13, 1911. Minute device with push-button.

1,018,375. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed July 8, 1909. Selective telephone signals.

1,018,376. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Sept. 2, 1909. Selective; for railroad telephone and telegraph work.

1,018,381. ELECTRICAL CIRCUIT SWITCH; J. M. Smith, Philadelphia, Pa. App. filed May 25, 1910. Lever switch for ignition work.